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THE JOURNAL

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(The following article, read by title at the December meeting of the Society, was omitted from the January number of the JOURNAL for lack of space.)

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY.

BY A. P. MORGAN.

[POLYPOREI.—Concluded.]

Genus III. TRAMETES, Fr.

Pores subrotund, obtuse, entire, often unequal in depth, sunk into the substance of the pileus; the trama, hence, contiguous and similar with the substance of the pileus.

Fungi lignatile.

a. Pores small or minute.

1. T. SCUTELLATA, Schw. Pileus corky, dimidiate and subungulate, or more commonly suborbicular, and attached by the apex, white then brown and blackish. Hymenium concave, white-pulverulent, with a somewhat elevated sterile margin: pores long, punctiform, with very thick obtuse dissepiments.

On stumps and old dry trunks, the scutellate form especially on the underside of rails in fences; common. Scarcely exceeding an inch in breadth, and usually about half an inch. The dimidiate pileus becomes rugged and uneven, and changes to brown and blackish, retaining, however, the white margin; sometimes concentric furrows and folds are found upon it. There are all stages between the dimidiate and the scutellate forms. The pores average about .22 mm in diameter, but the dissepiments, which are always included in the average, are as broad as the pores. This is the *T. Ohiensis*, Berk.

2. T. RIGIDA, B. and Mont. Pileus corky, undulate, by far the greater part resupinate; the margin short, acute, subzonate, tawny-brown. Pores medium, round, equal, obtuse, whitish.

In woods, on the lower side of old trunks; not uncommon. Often all resupinate and effused for a foot or more, the narrow margin seldom projecting half an inch. The pores are long, round and very regular, measuring about .33 mm. It is an elegant species.

3. T. SERIALIS, Fr. Pileus stuppeo-corky, effuso-reflexed, seriately elongated, narrow, confluent, rugose and serobiculate, with appressed hairs, brownish-yellow, the margin white. Pores obtuse, minute, unequal, white.

On the underside of an old trunk; no doubt rare. Mostly resupinate, and confluent to the extent of a foot or more, the margin reflexed scarcely half an inch. Perennial, and the first year all white, but these older specimens are cinereous and brownish. Readily distinguished from *T. rigida* by its minute, unequal pores. My specimens are two years old.

b. Pores large, unequal.

4. T. SEPIUM, Berk. Pileus coriaceous, normally subtriquetrous and porrect behind, finely tomentose, pale wood-color, with darker zones. Pores very large, subflexuous, pallid: the dissepiments rather thin, but entire.

On trunks and branches in woods, but more especially on the dry rails and boards in fences. Pileus about half an inch in width, but often effuso-reflexed, and laterally confluent to the extent of several inches, also sometimes wholly resupinate. The context is thin and coriaceous. The largest pores at first are subrotund, with rather thick dissepiments, but these at length become thin and flexuous; they measure about .7 mm. in diameter. It is the *Daedalea sepium*, Berk. of Lea's Catalogue; but it may be well to say that the genus *Tremetes* was not at that time established.

5. T. PALLIDO-FULVA, Berk. Pileus corky-coriaceous, rather thin, subimbricate, azonate, minutely pubescent, tawny. Pores at first subrotund, unequal, obtuse: at length becoming lacerate and elongated, the dissepiments often sublamellate

In woods on trunks, especially of Sugar Maple. Pileus 1–2 inches in breadth, and projecting as much as an inch. Often confluent, and much imbricate or effused and resupinate. An elegant resupinate form, with a thin edge, and a wide, sterile border grows

on the bark of the White Ash; it resembles the following species, except in color; it may be the *Polyporus cervinus* of Persoon. This may be the same as the *Lenzites vialis*, Peck, which grows so abundantly on the Oak railroad ties, but they differ greatly in color.

6. T. MOLLIS, Smfdt. Resupinate, determinate, woody-pallid, at length brownish; the margin at length revolute; and the underside pubescent, umber. Pores ample, unequal and lacerate.

On the bark of the dead branches of Sugar Maple, in the tops of fallen trees. Discrete and separable from the matrix, although wholly resupinate, but the margin free all around and often involute and clothed on the under side with spongy down. Pores very large .42 mm, subrotund and elongated, flexuous. From an inch or two in length or breadth, elongated to several inches or even a foot. A very elegant species. My specimens are gray becoming brownish, umber on the underside: they answer well to the description of *P. cervinus* in Berkley's Outlines.

Genus IV. DÆDALEA, Pers.

Pores firm, when fully grown sinuous and labyrinthi form: in other respects wholly like Trametes.

a. Pileus corky.

1. D. AMBIGUA, Berk. White. Pileus corky, horizontal, explanate, reniform, subsessile, azonate, finely pubescent, becoming glabrous. Pores from round to linear and labyrinthiform, the dissepiments always obtuse and never lamellate.

On old trunks of Sugar Maple; common. It begins its growth in Spring as round white nodules; specimens gathered in Summer are often thick and convex or gibbous; it finishes its growth along in Autumn, when it has become flattened out, depressed above and with a thin margin. I have indeed, however, specimens two years old in which the growth of the first year is wholly inclosed by that of the second year. There is sometimes a distinct round stipe as much as half an inch in length and oblique to the pileus, but more commonly the pileus is sessile by a somewhat circular base. When fresh and growing it is of a rich cream color, with a soft velvety feeling and a pleasant fragrance; the color of the mature specimens is well described by Berkeley as *dealbatus*, whitewashed: while older-weathered specimens become wood colored and brownish. The surface is usually quite smooth and even, not at all zonate, but

sometimes there are one or two concentric furrows toward the margin; I have specimens that are tuberculose and others that are very rugged and uneven. It varies greatly too in size; I have perfect specimens from one to seven inches in diameter, though it is commonly 3–5 inches in width.

I have diagnosed the species as appears to me the typical form in this region, retaining Mr. Berkeley's name as exceedingly appropriate I consider *Trametes lactea*, Berk. and of course *T. incana*, Berk. to be the same thing with the pores all subrotund. Fries evidently had a Trametoid form when he changed the name to *Trametes ambigua*. (Nov. Symb. p. 96.) I think that *D. glaberrima*, B. & C. and *Lenzites glaberrima*, B. & C. are not specifically different; and so far as description goes *Trametes elegans*, Fr. and *T. centralis*, Fr. must be very closely related species. I have no doubt that when this elegant fungus is well known it will be found to have appeared under many different names.

2. D. AUREA, Fr. Golden-yellow. Pileus corky-coriaceous, gibbous, velvety, subzonate, uniform in color; the substance yellow. Hymenium from porose, narrowly sinuate and labyrinthiform, yellow.

Upon trunks of oak; rare. Pileus triquetraus, about 2 inches in breadth, the margin tumid. It is said to vary considerably in its color and in the hairiness of the surface.

3. D. CONFRAGOSA, Bolt. Pileus corky, a little convex, subzonate, uniform in color, reddish-brown, wood-color within. Pores from subrotund and flexuous to narrowly labyrinthiform and lacerate, cinereous-pruinose then reddish-brown.

On the dead branches of standing trees of *Cratægus tomentosa*, rarely on other wood. This is another protean fungus which appears under many different names. See Peck, 30th Report p. 71. The form commonly met with here is the *Lenzites Cratægi*, Berk. of Lea's Catalogue. It grows attached by the apex to the underside of the branches with the orbicular hymenium downward; occasionally I find it dimidiate on the trunk. The pileus varies from $1\frac{1}{2}$ to 3 inches in diameter; it is brown-zonate and concentrically furrowed and often radiately rugulose or sulcate. The pores at first are essentially trametoid; they become oblong and flexuous at maturity, and lenzitoid only in old and weathered specimens. The form, *Trametes rubescens*, A. & S., with linear straight pores is rarely met with on branches in wet woods.

B. Pileus coriaceous.

4. D. UNICOLOR, Bull. Pileus coriaceous, villose-strigose, cinereous, with zones of the same color. Pores labyrinthiform, flexuous, intricate, acute, at length lacerate-dentate.

In woods on trunks of all sorts; common. Pileus 2–3 inches in breadth and projecting an inch or more, usually more or less connate and imbricate; older specimens become gray and yellowish with more marked zones and concentric furrows and ridges. The pores are whitish-cinereous or sometimes brownish; they are soon broken up into irregular plates and teeth. I occasionally meet with specimens extensively effused and nearly resupinate.

Genus V. FAVOLUS, Fr.

Hymenium reticulate cellulose or alveolate. Alveoli radiating, formed of densely anastomosing lamellæ; elongated. Spores white. Fungi epixylous.

1. F. CANADENSIS, Klotsch. Pileus fleshy-tough, thin, reniform, fibrillose-scaly and tawny, becoming pale and glabrous. Stipe eccentric or lateral, very short or obsolete. Alveoli angular, elongated, whitish; the dissepiments becoming thin, rigid and dentate. Spores oblong, .012x007 mm.

In woods on fallen branches, especially of Hickory, common. Pileus 1–2½ inches in breadth, sessile or with a very short stipe. Specimens with an eccentric stipe resemble *Polyporus lentus*, Berk., but the pores are much larger than those of this species. This is undoubtedly the *Polyporus Boucheanus*, Kl. of Lea's Catalogue, as is confirmed in the Notices of Berkeley under No. 44; but Fries, in the Novae Symbolae, seems to indicate that these American forms are not his species, and certainly the description in the Epicrisis does not apply to our plant. Specimens from New England gathered by me are glabrous, or scantily fibrillose, and may be the *F. Alutaceus*, B. and Mont.; they are, no doubt, what is meant by *Polyporus Boucheanus*, var *peponinus*, B. and C., in the Notices of N. A. Fungi, under No. 44. The original description of Klotsch was based upon a single specimen in the herbarium of Hooker, and it applies remarkably well to our plants, except that the pileus is sometimes lobed as in *F. Alutaceus*, B. and Mont.

Genus VI. MERULIUS, Haller.

Hymenophore formed out of a mucedinous interwoven mycelium, covered by a soft-waxy contiguous hymenium; the surface of

the latter reticulate with obtuse folds, incompletely porous, at length gyrose and obsoletely dentate. Fungi epixylous.

a. Pileus sessile, dimidiate.

1. M. RUBELLUS, Peck. Pilei sessile, confluent and imbricated, repand, thin, convex, somewhat tenacious, subtomentose, glabrate, red becoming pale. Hymenium. whitish or reddish ; the folds much branched, porose-anastomosing. Spores white, elliptic, .004–005 mm. long.

In woods on old trunks and branches; not uncommon. Pileus 1–3 inches in breadth, or confluently several inches. This is a very beautiful species, never resupinate or effuso-reflexed as the following ones, but always sessile and more or less confluent and imbricated; the color varies from flesh-color to deep red, fading out with age ; the hymenium is commonly an elegant cream-color, but sometimes it is pure white, and occasionally it is tinged with red. This is most likely the *M. incarnatus*, Schw., of Lea's Catalogue, but specimens compared with those of this species in Schweinitz's herbarium were declared to be different ; furthermore, in the N. A. Fungi, Schweinitz insists that his species is incorrectly referred to Merulius, and is a Cantharellus.

b. Pileus effuso-reflexed, with a determinate border.

2. M. TREMELLOSUS, Schrad. Resupinate; then free or reflexed, fleshy-tremellose, tomentose, white, the margin dentate radiate. Folds porose, various in form, reddish. Spores white, a little curved, .004–.005 mm. long.

In woods on old trunks and branches; common. Substance cartilaginous-gelatinous , the younger fungus all resupinate, orbicular, pallid, with a radiate and free border ; at length becoming reflexed sometimes to the extent of an inch, and much confluent and even imbricated ; in drying, the color changes to alutaceous, and that of the hymenium to brownish.

3. M. CORIUM, Fr. Resupinate-effused, soft, subpapyraceous ; the border at length free, reflexed, villous underneath, white. Hymenium reticulate-porose, flesh-color or pale alutaceous.

In woods on bark of Sugar Maple ; rare. My specimens are an inch or more in breadth and 3–5 inches long, with a very narrow reflexed border ; at first they were nearly white, but in drying have taken on a fleshy tint. In the Handbook of British Fungi, the spores are said to be vivid orange, oval, .006 mm. long.

c. Resupinate-effused, with a byssine border.

4. M. HIMANTIOIDES, Fr. Effused, bombycine, very soft, fibrous-silky underneath ; the border byssine. Folds porose, then gyrose : dirty yellowish, then subolivaceous.

On rotten wood of Beech; rare. The whole of a silken texture, loosely adherent and variable in form; the margin loosely tomentose. The folds at length poriform, crisp, flexuous; the color gray, violaceous, olivaceous, dirty yellow, etc.

5. M. MOLLUSCUS, Fr. Effused, thin, soft, membranaceous; the margin byssine white. Folds porose-gyrose, flesh color.

On rotten wood of Sugar Maple; rare. Extensively effused for several feet along the side and underneath a rotten log, forming a soft loosely adhering membrane, the color fleshy or creamy-white. The dried specimens are orange or brownish and the folds in some places shrunken into ridges and tubercles.

6. M. PORINOIDES, Fr. Crustaceous-adnate, thin; the border byssine, white. Folds poriform, distant, dirty yellow.

On rotten wood of Oak; rare. Effused to the extent of 2 or 3 inches, crustaceous, thin, persistent; younger specimens are all villous and white; the pores are round or linear and flexuous.

Genus VII. POROTHELIUM, Fr,

The fungus composed wholly of the interwoven mycelium, resupinate-expanded and submembranaceous; from which project papillæ at first distinct, soon porose-opened, at length elongated and tubular.

1. P. FIMBRIATUM, Pers. Effused, membranaceous, tenacious, white; the border with a fringe of terete laciniæ. Warts of the pores hemispheric, superficial, at first and on the border distinct, afterward confluent in the middle.

On the lower side of logs and wood of all sorts; common. A very elegant fungus. Widely effused and membranaceous, with a white fringed margin. The mass of the pores becomes crowded and confluent, while only the marginal ones remain distant and distinct; yet the hymenium never looks like that of a Polyporus.

Genus VIII. SOLENIA, Hoffm.

Receptacle none, tubules membranaceous, subcylindric, discrete and free from each other; the mouth connivent.

1. S. FASCICULATA, Pers. Gregarious, subfasciculate, clavate-cylindric, somewhat silky, white.

On old bark of Beech; rare. Tubules in my specimens 1–2 mm. long, crowded and somewhat fasciculate; in its younger state granuliform, soon annuliform, at length becoming cylindric and enlarged upward; externally silky with appressed hairs.

2. S. OCHRACEA, Hoffm. Scattered, clavate-cylindric, tomentose, ochraceous, white within.

On rotten wood of Maple; rare. Tubules less than a millimeter in length, about .6 mm. in my specimens, and covered with short rigid hairs; they do not seem scattered to the naked eye, but the lens shows that they are not crowded. The species is closely related to *S. anomala*, Pers. but the tubules of the latter rest upon a distinct floccose subiculum, while the mycelium of the former is scarcely apparent.

PROCEEDINGS OF THE SOCIETY.

MEETING OF *January* 5, 1886.

PRESIDENT HARPER in the chair and seventeen members present.

The following names were proposed for membership:

Miss Fanny Field,	Miss Elsie C. Field,
Miss M. C. Collins,	Miss Helen L. Herron,
Dr. W. W. Dawson,	J. E. Bruce,
Howard Barney.	

The following were elected regular members:

Rev. H. D. Waller,	John H. Warder,
Geo. W. Eger,	Dr. W. K. Boylan,
Joseph Nichols,	Dr. B. M. Ricketts,
T. B. Collier,	Miss Anna M. Brown,
S. S. Bassler,	Warner Galway.

Mr. William Beer then read, by invitation, a paper of Roman Remains in Britain. He spoke especially of the Roman Wall, which extended from New Castle-on-Tyne across England to Carlisle on the western coast, describing the aspect of the country and the appearance of the Wall together with the manner in which it was built and its purpose.

The committee on Rules for Sections made a report, and the following rules were adopted:

Rules for the organization of Sections in the Society of Natural History:

Rule I. Sections may be organized by the request of five members, addressed to the Curator of any department designated by Section 6, Article II., of the By Laws. The Curator shall then give general notice of a meeting for organization, either at a general meeting of the Society or by written notice to all the members. No person not a member of the Society shall be permitted to join the Sections.

Rule II. Officers of Sections, except the chairman, may be elected by Sections. The Curator of the department under which a Section is organized must be *ex officio* chairman, as prescribed by the By-Laws.

The time of meetings and such rules as may be necessary for their government may be adopted by Sections, provided such rules shall not conflict with the Constitution and By-Laws of the Society, and shall be subject to revision by the Society, to whom said rules shall be submitted for approval.

Rule III. Sections may assess their members for such expenses as may be directly incurred by the Section, but they shall not incur any indebtedness unless there is money in the hands of its treasurer to cover the same; and the Society shall not become liable for any expenditures that may be made, unless an appropriation shall have been allowed by the Executive Board. On the dissolution of a Section, any balance of money in its treasury or property it may have acquired shall be transferred to the Society.

Rule IV. Papers read before Sections intended for publication in the JOURNAL of the Society, shall be presented to the Society either by title or by abstract, when they may, or may not, be referred to the publishing committee, as are papers in regular course.

Rule V. Chairmen of Sections shall make a report of the transactions of their Sections at each annual meeting of the Society in April.

The report of Committee on Revision of Constitution was read and received and laid over for consideration at the next meeting.

The following paper was read and referred to the Publication Committee:

CATALOGUE OF THE UNIONIDÆ OF THE MISSISSIPPI VALLEY,

By Geo. W. Harper, A. M.
Principal of Cincinnati Woodward High School.

The following catalogue is intended to include only those species of bivalve shells which are found in the Mississippi river or some of its numerous tributaries. As this region embraces a wide scope of country it is possible that some of the species which ought to appear may have been overlooked. The effort has been made to eliminate all synonyms, which fact will explain the omission of some names familiar to collectors. Many of these shells have a wider range than indicated in this catalogue.

For range and synonomy see catalogue of R. Ellsworth Call, published by the Des Moines Academy of Sciences. Many of the shells marked from Tennessee were collected by Prof. A. G. Wetnerby and myself, part in East Tennessee in the Powell and Clinch rivers and others in Duck and Elk rivers of Middle Tennessee. As these rivers are tributaries of the Tennessee, modified forms of all these species are undoubtedly found throughout the course of the Tennessee river.

Most of those marked from Ohio have been collected from the Ohio river, the two Miami rivers, Mill Creek and the Miami Canal, and within a radius of not more than twenty miles from the city. Shells not numbered are desired in exchange for those numbered.

FAMILY UNIONIDÆ.

(River Mussels.)

Genus Unio.

Unio abacus, Hald...Tenn.
" aberti, Conrad, . . Ark.
3 " acuens, Lea, . . . Tenn.
4 " æsopus, Green, . . O...
" affinis, Lea, ... La.
6 " alatus, Say, ... O.
" amœnus, Lea . . Tenn.
" andersonensis, Lea, "
9 " anodontoides, Lea, O.
10 " appressus, Lea, Tenn., Ala. . . . .

Unio apiculatus, Say, . . La.
" approximus, Lea, "
" arkansensis, " Ark.
" arquatus, Conrad, Ind.
15 " arctatus, " Ala.
16 " argenteus, Lea, Tenn.
17 " arcæformis, " "
18 " atrocostatus, " Ala.

Unio barnesianus, Lea, Tenn
" bellulus, " "

23 Unio bigbyensis, Lea Tenn
" biangulatus, " "
" biemarginatus " "
26 " boykinianus, " Ala.
" bournianus, " O.
28 " brevidens, " Tenn.
" brevis, " "

31 Unio camelopardilis, Lea, ...Tenn.
32 " capsæformis, Lea, "
33 " caperatus, " "
34 " capax, Green, .. Ill.
" calignosus, Lea,. Ark.
" callosus, " O.
" camptodon, Say, O., ...Tenn.
" chattanoogænsis, Lea, ...Tenn.
39 " cincinnatiensis, Lea, O.
40 " circulus, Lea, O., ...Tenn.
41 " circumactus, Lea, "
42 " clinchensis, " "
43 " clavus, Lam., O., ...Tenn.
" clarkianus, Lea, "
45 " cœlatus, Conrad, "
46 " coccineus, Lea, O., "
47 " cornutus, Barnes, O., ...Tenn.
48 " cooperianus, Lea, O.
49 " conradianus, Lea, ...Tenn.
" compressimus, Lea, "
" conasaugaensis, " "
" copei, " La.
" cor, conrad,.....Tenn
54 " crassidens, Lam., O., ...Tenn.
" creperus, Lea, "
" crudus, " "
57 " cumberlandianus, Lea, ...Tenn.
58 " cuneolus, Lea, "
59 " cylindricus, Say, O., ...Tenn.

Unio dactylus, Lea, Tenn.
" declivis, Say,....Ala.
" depygis, Conrad,.... .. ..Tenn.
" deviatus, Auth., "
" difficilis, Lea,....Ga.
" dispansus, " Tenn.
68 " dorfeuillianus, Lea, ...O., Tenn.
69 " dolabelloides, Lea, Ky.
70 " donaciformis, " O.
71 " dromas, Lea, ..Tenn.

73 Unio ebenus, Lea, O., ...Tenn.
74 " edgarianus, Lea, "
75 " elegans, Lea, ... O., ...Tenn.
76 " ellipsis, Lea,......O.
77 " estabrookianus, Lea, ... Tenn.

79 Unio fabalis, Lea, O.. Tenn.
80 " fassinans, " "
" fatuus, " "
82 " flavidus, " "
" florentinus " Ala.
84 " foliatus. Hild., ...O., ...Tenn.
85 " foremanianus, Lea,.. ....Ala.
" forsheyi, Lea, "
87 " fragosus, Conrad, O.
88 " fucatus, Lea,....Ala., ...Fla.
" fulgidus, Lea,....La.

91 Unio gibbosus, Barnes, O., ...Tenn.
" gibber, Lea, "
93 " glans, Lea, O., Tenn.
" glaber, " "
" glandaceus, Lea. Ala.
" globatus, Lea,..Tenn.
97 " gracilis, Barnes, O., ...Tenn,
98 " graniferus, Lea,...O.
" grandidens, " Ark.

Unio habetatus, Conrad, Mo.
" haleanus, Lea . . Miss.
" holstonensis, Lea, ... Tenn.

105 Unio intermedius, Conrad, ... Tenn.
" interruptus, Lea, "
107 " iris, Lea, . . O., Tenn.
108 " irroratus, Lea, O., Tenn
109 " jonesii, Lea, . . . Tenn.
" Kirtlandianus, Lea, O.

112 Unio lævissimus, Lea, O., ... Tenn.
113 " lacrymosus, Lea. . . O.
" lamarkianus, " Ark.
" lawi, " Ala.
116 " leseurianus, " Tenn.
117 " lenticularis, " O., ... Tenn.
" lenior, Lea, "
" lesleyi, " "
120 " ligamentinus, Lam., ... O., Tenn.
" lindsleyi, Say, "
" linguæformis, Lea, "
123 " luteolus, Lam. . . . . O.
" lyonii, Lea, ... Tenn.

Unio maculatus, Conrad. . . . . Tenn.
" mæstus, Lea, "
128 " metanever, Raf . . . O.
" menkianus, Lea, Tenn.
" meredithii, " "
131 " multiradiatus, Lea, O., ... Tenn.
132 " multiplicatus, Lea, O.
" muhlfieldianus, Lea . . . . Tenn.
" mundus, Lea. . . . . Ala.

Unio neglectus, Lea. . Ala.
" nitens, Lea. . . . Tenn.
" notatus, Lea, . . . Tenn.
139 " nux, " Ala.

141 Unio obliquus, Lea. . . . O., ... Tenn.

Unio obscurus, Lea, Tenn.
" obuncus, " "
" occidentalis, Conrad, ... Ark.
145 " orbiculatus, Hild. . . O.
" oviformis, Conrad . . . . Tenn.

148 Unio parvus, Barnes. . . . O.
" pattinoides, Lea, Tenn.
150 " perdix, " "
151 " personatus, Say, . . O.
152 " perplexus, Lea. . . . O.
" perplicatus, Conrad . . . . Miss.
" perpurpureus, Lea. . . . . Tenn.
" petrinus, Gould. . Tex.
" phillipsii, Conrad . . O.
157 " phaseolus, Hild. . . O., ... Tenn.
158 " pilaris, Lea. . . . . . . O.
159 " pictus, " Tenn.
" pileus, " O.
161 " plenus, " O., Tenn.
162 " plicatus, " O., Tenn.
" planicostatus, Lea. . . . . Tenn.
" planior, Lea . . "
" popenoi, Call. . . . Kas.
" powellii, Lea. . . . Ark.
167 " propinquus, Lea . Ga., ... Tenn.
168 " pressus, Lea. . . . . . . O.
169 " pulcher, " Tenn.
170 " punctatus, Lea, "
171 " purpuratus, Lam. Ark.
172 " pustulosus, Lea . . . O. . . . . Tenn.
" pudicus, Lea, "
" puniceous, Hald. "
175 " pustulatus, Lea. . . . O.
176 " pyramidatus, " "
177 " pybasii, " Tenn.

180 Unio rangianus, Lea . . . O.
" radiosus, " Tenn.
" ravenelianus, " La.
183 " rectus, Lam. O., Tenn.

184 Unio retusus, Lam......O.
" reevianus, Lea....La.
" regularis, " Tenn.
" rotundatus, Lam. La.
188 " rubiginosus, Lea...O.

191 Unio sayii, Tap........O.
" satur, Lea........La.
193 " schoolcraftii, Lea..O.
" scitulus, " Ala.
195 " securus, " O.
" simus, Lea.....Tenn.
197 " sowerbianus, Lea, "
198 " solidus, " O.
199 " sphæricus, " Ala.
" sparsus, " Tenn.
" sparus, " "
" spatulatus, " Iowa.
" stewartsonii, " Tenn.
" stonensis, " "
205 " subrotundus, " O., ...Tenn.
206 " subtentus, Say, "
207 " sulcatus, Lea......O.
208 " subrostatus, Say, La., ...Ill.
" subcroceus, Conrad.. .... Ark.
" symmetricus, Lea, La.

213 Unio tetralasmus, Say Ill.
214 " tenuissimus, Lea..O., ...Tenn.
" tellicoensis, Lea, "
" tener, " "
" tennesseensis, " "
" tesserulæ " "
219 " texasensis, Leá, I. T.
" thorntonii, " Ala.
221 " triangularis, Barnes.. ....O., Tenn.
222 " trigonus, Lea .. .Ill.
" trapezoides, Lea. Ala.
" troostii, Lea....Tenn.
225 " tuberculatus, Barnes.. .... O., Tenn.
" tuscumbiensis, Lea, "

Unio tuberosus, Lea Tenn.
" tumesceus, " "
" turgidulus, " "
" turgidus, " La.

232 Unio undulatus, Barnes, O.
233 " validus, Lea....Tenn.
234 " varicosus, " O.
" vanuxemii " Tenn.
236 " verrucosus, Barnes... ......O., Tenn.
237 " ventricosus, Barnes, O.
" venustus, Lea....Mo.
" virescens, " Tenn.
240 " wardii, " Iowa.
241 " zeiglerianus, " Tenn.

Genus Anodonta.

Anodonta argentea, Lea.... ....Tenn.
" bealii, Lea.......Tex.
244 " corpulenta, Cooper, Ill.
245 " danielsii, Lea....Neb.
" dejecta, Lewis....Ark.
" demigrata, Lea..Tenn.
248 " edentula, Say......O.
249 " ferussaciana, Lea...O.
250 " footiana, Lea...W. N. York................
251 " grandis, Say....Minn.
252 " harpethensis, Lea, Tenn.
253 " imbecillis, Say......O.
" opaca, Lea.......Ark.
255 " ovata, " Miss.
256 " pavonia, " O.
257 " plana, " O.
" pepiniana, Lea.....O.
" plicata, Hald.....Ky.
260 " salmonia, Lea.... .O.
261 " suborbiculatus, Say, Ill.
" tetragonia, Lea....La.
" virens, " "

Genus Margaritana.

265 Margaritana calceola, Lea .... O., Tenn.
" carreyana, Lea, "

267 Margaritana complanata, Barnes ....O.
268 " confragosa, Say..... Ill.
269 " dehiscens, " O., Tenn.
270 " fabula, Lea, "
" hildrethiana, Lea...Ind.
272 " holstonia, " Tenn.
273 " margaritifera, Linn. Nev.
274 Margaritana marginata, Say ....O.
275 " minor, Lea.......Tenn.
276 " monodonta, Say......O.
" quadrata, Lea.....Tenn.
278 " raveneliana, Lea..N. C.
279 " rugosa, Barnes.......O.

The following donations were announced. From S. S. Scoville, one Salamander ; from Mrs. Dr. Hazard, one Circum-Polar Map ; from Hon. Chas. E. Brown "Memoirs of National Academy of Sciences" Vol. III. part I, and "Statistics and Technology of the Precious Metals ;" from Signal Service officer, "Monthly Weather Review," October, 1885 ; from Director of Bureau of Ethnology, "Third Annual Report, for 1881-'82."

MEETING OF FEBRUARY 2, 1886.

PRESIDENT HARPER in the chair and fourteen members present.

The following papers were read by title and referred to the Publishing Committee.

REMARKS ON SOME FOSSILS OF THE CINCINNATI GROUP.

BY CHAS. L. FABER.

Genus PLUMULITES, Barrande; TURRILEPIS Woodward.

The fossils to which the above names were given, were for many years supposed to belong to the family Chitonidæ, and were so referred and described by M. L. de Koninck (Bull. de l'Acad. Royal des Sci., 1857), but in the Quart. Jour. Geol. Soc. London, 1865, p. 486, Mr. Woodward refers then to the Cirripedia, under the generic name of *Turrilepis*, there proposed, giving very clear reasons for considering them as Cirripedes and not Chitons.

In the supplementary volume of the Crustacea of the Silurian System de La Bohemia, the author (Barrande) describes several species under the generic name of *Plumulites*, not recognizing Woodward's genus, as its characters were not defined or described by the author. The general form of the body appears to have been elongate ovate, or elliptical, and is composed of four or more ranges of

imbricating plates of a somewhat triangular form, the whole somewhat resembling in appearance and character a loosely-arranged pine cone.

Several detached plates of a fossil found in the rocks of the Cincinnati Group have been figured and described under the name of *Plumulites Jamesi*, Hall and Whitfield. No perfect specimen was known at the time these plates were described. The author, however, having come into the possession of what seems to be a perfect specimen, and believing it to belong to another genus than *Plumulites*, has given it a new generic name with the following characters.

LEPIDOCOLEUS n. g.

Specimen sword shape, triangular in section having three unequal sides, composed of two long rows of overlapping plates, making a complete circumference. Ending of the upper extremity rather sharp, at the base (?) or lower extremity having a very short, rapid curvature towards the ventral side of the specimen. The upper row of plates has a very strong ridge or elevation near the side where the two long rows of plates are joined the dorsal side, which is nearly straight. The opposite long row of plates is flat, and has a rapid, short curvature upon the edge of the straight or dorsal side of the specimen, so as to meet the upper, or ridged row of plates, and joined with it in zig-zag manner of overlapping tiling, at one of the angles; and both meet each other like a knife edge at the second angle or ventral side. At this side or angle the specimen had the power of opening above the basal curvature, to the upper extremity, while the third angle forms the ridge or elevation of the upper long row of plates or ridged row of platest

The plates of both rows have the same form in outline, but reverse to each other, and have the same markings as in *Plumulites*. The plates have one long side from the apex, and a very short side which slants more rapidly than the other side, being almost straight down from the apex; they round off rather sharp on the long side, are broad on the short side and very characteristic in having scollops upon the long side

Lepidocoleus jamesi, (Hall & Whitfield) Faber.

Plate I, figures A. to F.—Magnified about 5 dia.

Specimen sword shape; triangular in transverse section, having three unequal sides, composed of two long rows of overlapping plates. The ridged row has fifteen overlapping plates, as shown in

figure *A*, Plate I, the plates varying but little in form and size. This ridge begins at the basal curvature and continues upon the edge of the dorsal side until the fourth plate, where it begins to leave the edge, and more so in the fifth; and in the sixth plate begins to take its regular course upon the specimen, approaching nearer the edge towards the upper extremity; it has a position upon the specimen about one-fourth of the entire width from the dorsal or straight side. The ridge is low in the basal curvature, and is highest in the center, still being very strong at the upper extremity. The plates in the basal curvature are so arranged as to make a very rapid, short curvature, forming a semi-circle and ending bluntly. (This may have been a point of attachment.) In the center the plates are the widest and gradually decrease in width towards the upper extremity, thus forming a long curvature from the fifth plate to upper extremity.

As the ridge has the position above mentioned, it thus leaves a very short rapid slope on the dorsal side, and a long slope on the other or ventral side, this slope being about three times as long as the other, with a general depression in the center of the slope. Each plate having a rather marked depression beginning at the ridge and top and sloping to the end of each plate. This depression has a position to the ridge of about thirty degrees, being strong in the central plates and very faint or wanting towards the upper extremity. I consider Plate No. I of Hall and Whitfield's *Plumulites jamesi*, figured in Ohio Pal. Vol. II., as one of these plates broken away from the ridge. The authors have thus been misled in describing it as triangular in form, and this form is very characteristic of the plates in the genus *Plumulites* or *Turrilepis*. Fig. D, Plate I, is an entire plate of this series, which has a position above the basal curvature, and if it were one of the basal curvature plates, it would have the slope towards the dorsal side, curved more towards the under part of the ridge, which, as before stated, causes the ridge to be on the edge of the basal curvature. This can be seen in figure *A*, plates 1, 2 and 3, having the slope entirely under the ridge; and in plate 4 this slope begins to show, and more so in the fifth, and in the sixth plate the slope shows its full length.

The opposite long row of plates or flat row, has fourteen to fifteen overlapping plates, as shown in Figure B, with a very strong general depression in the center of the specimen, above the basal curvature to the upper extremity. This row of plates makes a

very rapid and short curvature upon the edge of the specimen, on the dorsal side, so as to meet the ridged row of plates, and joining with it in zigzag manner of overlapping tiling, as seen in figure *C*, which is a dorsal view. This small curvature of the flat row of plates has a flat extension beyond it, as seen in figure *C* and *E*. Upon this extension the small slope of the ridged row of plates rests, with its edge against this small curvature. Thus these two rows lie in zigzag manner over each other, thereby making a very firm holding. This small extension exists even in the basal curvature.

I consider Figure 2. of Hall and Whitfield's *Plumulites jamesi*. as one of this flat row of plates, with this small extension broken away, but still leaving the curvature, and also broken away from this general depression shown in my Figure B, in the center of the specimen. Figure E shows these characters well, but the reader must not imagine that these can be seen in one view, as these are curved in under the plate so as to meet the other row, the curvature representing the space between the first and second line drawn from the apex of the plate, while the small extension represents the space between the second line and the edge of the plate. The flat row is more characteristic in having scallops than the ridged row. These two rows meet each other at the ventral side like a knife edge. Here it undoubtedly had the power of opening.

The plates of these rows bear the same markings as *Plumulites*, but differ greatly in form. These plates, *L. jamesi*, are the same in form, but being reverse to each other in the roundings of the lower extremity of the plates, as seen in figure *E* and *D*.

Figure F is a *dorso-ventral* section of the specimen, showing the three unequal sides.

The specimen figured by Mr. S. A. Miller I consider as the ridged row of plates, the ridge which separated the plates being broken. But as this specimen was not seen, I can not be positive, also I do not consider the figure as very exact.

The beautiful specimen here described was collected by Mr. Charles Wessels, in the Cincinnati Group about 150 feet above low water mark in the Ohio River at Cincinnati, and is now in the Author's collection.

Cyclocystoides nitidus, *nov sp.*

Plate I. Figure 1.

This specimen has a complete ring, composed of twenty-four marginal plates, which are somewhat elongate. The specimen is a

little pressed together and somewhat weatherworn; interior destroyed. Measures seven *mm.* in diameter.

Collected by Mr. Geo. Ashman, in the Cincinnati Group near Transit Ohio. about 400 feet above Low water mark in the Ohio River.

CYRTOCERAS TENUISEPTUM, *nov sp.*

Plate I. Figs. 3 a–b–c.

Specimen medium size, with slight curvature and tapering very slightly. Composed of twenty thin septa, equal in width and rather circular in section. Siphuncle small and dorsal. Specimen is thirty two *mm.* in length, and measures in section seventeen *mm.* in its greater, and fifteen *mm.* in its lesser diameter.

3a is a dorsal view of a larger specimen of the same species, having five septa and a body-chamber showing the sinus. The body chamber is 27 *mm.* in length, and measures in section 23 *mm.* in its greater, and 20 *mm.* in its lesser diameter. This specimen has a thick shell, but shows no external markings. It also shows that a coral had begun its growth in the body-chamber and extended somewhat beyond it. This species has about seventeen septa to an inch. 3a is a remarkable specimen, as it is the only one figured and known to me of this group with a complete body-chamber.

Collected by the author in the Cincinnati Group near Waynesville, O., and at Versailles, Ind.

In the 35th Report of the N. Y. State Museum, Mr. C. D. Walcott describes two species under the genus of MEROCRINUS. As a specimen which I have proves to belong to this genus, and is the same species which Mr. Ulrich has described and figured in Vol. II., Plate 7, figure 14 of this JOURNAL as *Dendrocrinus curtis*, with a question as to the genus, I therefore figure the specimen to give a better idea of it and place it under the genus MEROCRINUS. Below is the description of the genus as given by Mr. Walcott:

"MEROCRINUS.—WALCOTT.

"General appearance of the body not unlike that of some species of *Heterocrinus* and *Dendrocrinus*.

"Underbasals pentangular, low and broad in the typical species. Basals hexagonal; radials pentagonal. Brachials six to seven in each ray, the upper plate pentagonal and supporting the free divisions of the arms above. In the right posterior ray there is a

bifurcating plate resting on the radial below and supporting above on its right sloping side the true brachial series of the arm, and on the left a row of quadrangular plates, vertically arranged. This series of plates resemble the brachial plates, except that they are more elongate. They undoubtedly formed the posterian side of an anal tube, corresponding in this respect to the same series of plates in the genus *Iocrinus*. Arms bifurcating frequently, gradually tapering. Pinnulæ unknown.

"The arrangement of the plates forming the calyx is similar to that in *Dendrocrinus*, except that the regularity of the radial series of plates is not broken by the interposition of the anal plates. In this respect *Merocrinus* is allied to *Iocrinus*, and also in the position of the plates supporting the anal tube. It differs from *Iocrinus* in having a well-developed ring of underbasals, and also in the general appearance of the entire body."

MEROCRINUS CURTIS, (Ulrich.) Faber.

Plate I. Figure 2.

Body short, broad, increasing very little in width to the base of the arms. Underbasals very short, more than twice as wide as high. Basals rather obscurely hexagonal, with a width equal to one and a half times the length. Radials a little larger than the basals, a little wider than high, and pentagonal. The first right postero-lateral plate above the radial is pentagonal, and supports the brachial plates on its right sloping side, and on the left the posterior plates of the anal tube. The brachial plates are quadrangular and twice as wide as high. The first bifurcation of the postero lateral ray occurs on the sixth plate above the bifurcating plate below, and the other rays bifurcate on the sixth plate above the radial ring of plates. One of these rays supports three arms at this bifurcation, but this is undoubtedly abnormal. The posterior plates of the anal tube are a little longer than wide, and about one half as wide as the brachials, and are very convex on the outerside, and rise from the left sloping side of the second radial.

Column round, composed of thin joints, nearly smooth, increasing in size downward.

So far, this is the only specimen found besides the one of Mr. Ulrich. Its rarity is well known to local collectors.

Collected by the Author in the lower part of the Cincinnati Group, about forty feet above low water mark at Ludlow, Ky.

Description of Plate I:

Figure A. *Lepidocoleus jamesi*, showing the ridged row of plates and basal curvature.

B. The same specimen, showing the flat row of plates and central depression.

C. The same specimen, dorsal view, showing zigzag manner of joining of the two rows, and also the height of the ridge.

D. Plate of the ridged row.

E. Plate of the flat row.

F. Dorso-ventral section, showing unequal sides of specimen.

Figure 1. *Cyclocystoides nitidus*, nov. sp.

Fig. 2. *Merocrinus curtis*, Ulrich.

Fig. 3*a*. *Cyrtoceras tenuiseptum*, nov. sp. showing body-chamber.

3*b*. Smaller specimen, with twenty septa.

3*c*. Section of 3*a*.

Fig. 4*a*. Longitudinal section of *Gomphoceras powersi*, James *f*. Showing septa and remains of siphuncle.

4*b*. Transverse section, showing position and approximate size of siphuncle. (For description of this species with figure, see this JOURNAL, Vol. VIII., p. 255.)

CLARIFICATION OF THE PUBLIC WATER SUPPLY OF CINCINNATI.*

BY C. R. STUNTZ,

Professor of Chemistry, Woodward High School, Cincinnati.

This paper embodies the following points:

1st. A brief synopsis of the available material published pertaining to the chemical clarification of water.

2nd. A record of the experiments that were deemed necessary to determine whether the public water supply of Cincinnati can be practically and economically clarified by chemical agents.

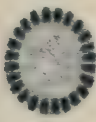
3rd. General deductions from the tests, and some comparisons of the water clarified by precipitation with that clarified by a combination of precipitation and filtration.

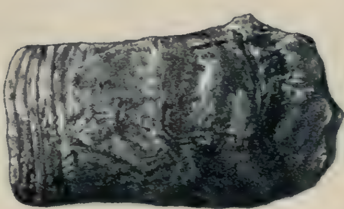
*This paper is a report prepared by Prof. Stuntz, for the Board of Public Works of Cincinnati. It was given in substance as a lecture before this Society on January 29, then read, by invitation, (by title) at the Society meeting on February 2.—[NOTE BY EDITOR.]


A.


C.

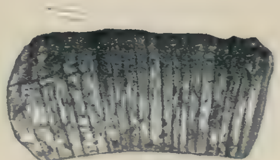

B.


1.


3 a.


3 c.


2.

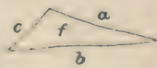

3 d.


E.


D


4 b.


4 a



Synopsis of Published Material.

The published work in reference to the separation of finely comminuted matter from water that holds it in suspension is for the greater part contained in papers treating on dynamical Geology, and has been developed in the investigation of the causes which have produced the varied and extensive formations resulting from Sedimentation.

T. Sterry Hunt[1] has shown that the mud held in suspension in the water of the Mississippi River is completely precipitated out, and the water becomes clear in from twelve to eighteen hours by the action of Sea Water, Common Salt, Epsom Salt, Alum, or Sulphuric Acid.

Brewer[2], after many experiments with various precipitants upon water mixed with clay, both as found naturally in turbid streams or artificially prepared by himself with different kinds of clay, arrives at the hypothesis that the clay held most tenaciously suspended in water is combined with it in the colloid form. He leaves the reader to make the deduction natural to the case, that the action of a precipitant in clarifying the water is to break up the colloid molecules that hold the solids in suspension, which then fall out by gravity.

D. Waldie[3], on investigating the water supply of Calcutta, with reference to the use of the water of the Hoogly River, reports that certain salts have the power of coagulating the clay held in suspension in turbid river water. The most prominent of these are the Salts of Alumina and Ferric Oxide. It may also be accomplished by alkalies, alkaline earths, and also by the acids, Nitric Acid, Muriatic Acid, Acetic Acid and Sulphuric Acid.

Waldie's Table[4].

The following table is given by Waldie, showing the relative weights of the substances named required to produce the same results in precipitation:

Common Salt	4680
Caustic Potash	560
Bicarbonate of Soda	672
Acetic Acid	360

1. Society of Nat. Hist. Report, Boston, Mass., February, 1874.
2. Memoirs of the National Academy of Sciences, U. S. A., 1883; and American Journal of Science, January, 1885.
3. Journal of the Asiatic Society of Bengal II. 1873.
4. Chemical News II. 1873.

Sulphuric Acid	196
Calcium Cloride	222
Magnesium Chloride	182
Nitric Acid	189
Barium Chloride	208
Bicarbonate of Lime	100
Calcium Sulphate	136
Bicarbonate of Magnesia	84
Magnesium Sulphate	75.5
Copper Sulphate	31.8
Ferrous Sulphate	22.8
Ferrous Bi-sulphate	17.4
Alum	7.92
Aluminium Chloride	4.48
Ferric Chloride	2.74

Alum.

The Chinese,[1] according to Sherard Osborne, use alum for the purpose of purifying the water of the Peiho at Tien-tsin, and, as shown by their traditions, they have used it for centuries on the waters of that and other interior rivers of China.

This substance so long known is still in the front rank of practical agents used for the clarification of liquids containing suspended impurities. It is used in many industries. The manufacturer of Common Salt who works ferruginous brines, after separating peroxide of iron by boiling, finds alum both the cheapest and most efficient agent for clarifying the salt water.

It is used by the chemist, the pharmacist, the brewer, the manufacturer of effervescent beverages, and many others who require clear water and whose supply comes from turbid streams.

Albumenoids.

Liquids may be separated from suspended solids by the action of abuminous substances. This is practically done in the industrial way by dissolving the albumenoid in the impure liquid, and then coagulating the mass by the action of heat or an astringent mineral.

Syrups are mixed with the albumen of eggs, blood and milk in the cold and then heated to boiling. The heat coagulates the albumen about the solids and the ascending steam carries the

1. Water analysis. Wanklyn's Purification of Water, and American Journal of Science, January, 1885.—Brewer.

whole to the top in a frothy mass which is removed by skimming.

The clarification of wines is produced by solution of pure albumen or of dried blood, with the addition in some cases of ground gypsum. The natural ingredients of the wine slowly coagulates the albumen which falls out carrying with it the solid impurities.

Ferruginous Brines are readily settled by milk, eggs or blood, the astringent oxide of iron and other minerals, acting as coagulating material, while the heavy oxide of iron quickly carries the whole to the bottom.

A. B. C. PROCESS FOR CLARIFYIMG SEWAGE[1].

Treat the Sewage collected in a quiet basin with a mixture of Animal Charcoal, Blood and Clay. Then follow with a solution of Per-chloride of Iron. The process will be hastened by the addition of Alum.

RECIPES FOR THE CLARIFICATION OF POTABLE WATER.

1. By Crookes[2] for precipitating the unhealthy water of the Gold Coast, Africa:

Calcium Permanganate ($Ca\ Mn_2O_8$)	1
Aluminic Sulphate ($Al_2 3So_4 18H_2O$)	10
Fire Clay..................................	30

2. From Hager[3] for Turbid Water.

0.5 Gramme. of Aluminic Sulphate ($Al_3 3So_4 18H_2O$) to a Litre of muddy water.

3. From Hager[4] Antiseptic:

Aluminic Subsulphate, ($3Al_2 3So_4 2Al_2O_3 3H_2O$). Teaspoonful in 5 Litres of water.

4. From Hager[5], for Impure Turbid Water:

Aluminic Sulphate, ($Al_2 3So_4 18H_2O$) 5 Grammes.

Dissolve in 100 c.c. of water and use for the clarification of 1000 Litres of turbid water. Follow by a solution of Permanganate of Potassa, containing from 4 to 5 Grammes of the $KMnO_4$ to a Litre until it is no longer decolorized.

In soft water the Aluminic Sulphate may be reduced up to 3.1 to the 100 c.c. for 1000 Litres of water.

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1. Chemical News, I, 1868.
2. Chemical News, I. 1868.
3. Pharmaceutische Praxis, I S. 201 and 262.
4 & 5. Pharmaceutische Praxis I, 262. 387.

Process for Making Hard Water Soft.

1st. Clark's[1], for water temporarily hard:

Add milk of lime equivalent to the carbonic acid that holds metallic carbonates in solution and mix thoroughly.

Holland Process.[2]

Calcined Soda (Na_2CO_3)............. 3 Grammes.
Soluble Glass. Dry. (Soda)......... 1 "

10 Grammes of the mixture in 100 c.c. to soften 100 Litres of hard water.

Process of Clarifcation.

The practical processes for the clarification of a public water supply seem to be limited to four:

1st. Subsiding the water in basins.

2nd. Subsiding in basins after treatment with a precipitant.

3rd. Filtration.

4th. Filtration after treatment with a precipitant.

The first is the one in general use. In this the water standing in basins of large surface and comparative little depth has its whole body subjected more or less to the action of sunlight and to the oxidizing action of the atmosphere. The albuminous substances, which exist in some quantity in all surface waters, and which greatly increase the tenacity with which clay and other solids adhere to water, are oxidized to mineral matter and fall out together with the solids.

This is Nature's method for the clarification and purification of water, and it is remarkably exemplified in the high degree of purity of all the great lakes of fresh water, and also in the rapid self-purification of all bodies of water of considerable size exposed to air and sunlight when the amount of organic matter is not excessive.

Subsiding the water in basins after treatment with a precipitant is also an imitation of a process of Nature.

The exceedingly rapid purification of running streams is clearly the result of the oxidizing effect of the air, rendered more complete by the currents, rapids and eddies that stir the waters, and by bringing all parts in succession to the surface, perfectly aerate the whole mass. This effect is further augmented in streams flowing in natural beds in the earth by the mineral substances which are

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1. See Water Analysis.—Wauklyn.
2. Phar. Praxis.

dissolved in the water or swept into the currents in the solid state. All of these act as precipitants of the organic matter in the water.

This effect is strikingly apparent in the bright and sparkling water produced in streams of small size when they are fed by the waters of chalybeate springs.

It is apparent in the rapid purification of all streams which are the receptacles of sewage. The Oder River, which receives the sewage of Breslau, practically purifies itself in fourteen kilometers flow below the city.[1]

The waters of the Ohio River, after receiving the drainage of an immense agricultural district and all of the sewage of the cities and towns on its banks and tributaries, comes to us in a purer condition, so far as chemical analysis can now show, than that of the water of the wells and springs on its banks and adjacent uplands.

The process of purification by filtration, attended with the action of coagulating material, is likewise in imitation of natural processes. The surface water, contaminated with foul organic matter, the detritus of vegetables and animal remains, when it sinks into the ground comes in contact with the saline ingredients of the soil, and its slimy albuminous matters are coagulated near the surface, and as it sinks further through the earth, partly by oxidation, partly by subsidation and straining out, the impurities are left in the rocky interstices, and the water, clarified and pure, issues in the generous spring or the sparkling well.

Tests of Precipitants Used in Subsiding Potatble Water.

In the following tests, the sample of turbid water operated upon was in each case one Liter, contained in a wide-mouthed glass bottle with a glass stopper. The water stood in a column about seven inches high and three inches in diameter.

The precipitants were all dropped from the same Mohr's Burette.

The effect of the precipitants was observed by placing from six to eleven bottles in a row, and adding to the second the minimum amount estimated to produce an effect, and then adding to the remainder amounts increasing in an arithmetical ratio. The effects were then recorded at different times.

It was determined that the hardness of the water of the various samples would sufficiently show the chemical action.

1. Dr. Franz Hulwa. Biedermanus, Cent. Blatt, fur Agricultur Chemic. 13-1.

The hardness is expressed in metric degrees, or the number of parts by height of Carbonate of Lime, or its equivalent in 100,-000 parts by weight of water.

Metric degrees multiplied by 0.7=Grains in an Imp. Gal.
" " " 0.583= " a U. S. "

Since potable water is also used in industries in which Iron is injurious, in those series in which Iron Salts are the precipitants, this element was determined in the clarified water.

The amount of Iron was found by color titration with Potassic Sulphocyanide.

Tabulated Tests of Water Clarified by Precipitation.

Series 1, Canal Water. At Sycamore Street, Nov. 29, 1884.
Precipitant, Perchloride of Iron Solution. Sp. Gravity 1.74.
1 Drop=0.030 G.

No. Samples	No. Drops	Effect in Given Time.						Hardn's	Iron.
		At Once.	½ hr.	3 hr's.	24 hr's.	48 hr's.	72 hr's	Ca CO_3 in 100,000	Ft. in 1,000,000
0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	36.1	0.7
1	1	Rd Yel	Rd Yel	Rd Yel	Rd Yel	Co'gl'g	Op'l'nt		
2	2	"	"	"	Co'gl'g	Clear	Bright	37.6	0.6
3	3	"	" deeper.	Co'gltg	Bright	Bright	"		0.6
4	4	"	"	Cle'r'g	"	"	"	38.4	
5	5	"	Co'gl'g	Bright	"	"	"		0.7
6	6	" Deeper.—	Cle'r'g	"	"	"	"	40.9	
7	7	"	"	"	"	"	"		1.5
8	8	"	"	"	"	"	"	42.8	
9	9	"	"	Cle'r'g	Clear	"	"		
10	10	"	R'd Bn	R'd Bn	Fl'c'lar	B'n Flr	Clear		

Series 2. Hydrant Water. December 18, 1884.
Precipitant, Subsulphate of Iron Solution. Sp. Gravity 1.418.
1 Drop=.053 G.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	11.5	
1	1	Rd Yel	Rd Yel	Rd Yel	Co'gl'g	Clear'g	Op'l'nt		
2	3	"	"	Co'gl'g	Clear	Bright	Bright	12.0	
3	5	"	"	Clear'g	Bright	"	"	14.8	
4	7	"	"	Clear	"	"	"	17.5	
5	9	"	"	Rd Yel	Rd Yel	Co'gl'g	Fl'culr		

Series 3. Hydrant Water. December 18, 1884.
Precipitant, Ferric Chloride Sol. Sp. Gravity 1.345.
1 Drop=0.022 G.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	11.5	
1	2	Rd Yel	Rd Yel	Rd Yel	Op'l'nt	Op'l'nt	Op'l'nt	12.1	
2	4	"	Co'gl'g	Clear'g	Bright	Bright	Bright	13.3	
3	6	"	"	"	"	"	"	15.1	
4	8	"	"	Red'sh	"	"	"		
5	10	"	Rd Yel	Rd Yel	Rd Yel	Clear	Red'sh		

Series 4. Hydrant Water.
Precipitant, H_2SO_4. Did not clarify—Water Acid.

Series 5. Hydrant Water. December 26, 1884. (Not satisfactory.)
Precipitant, $FeSO_4$, and H_2SO_4 to strong Acidity.
0.01 G. $FeSO_4$ to the c.c.

0	0 c.c.	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow		
1	$\frac{1}{2}$ c.c.	"	"	"	"	Op'l'nt	Op'ln't		
2	$\frac{3}{2}$ c.c.	"	"	"	Co'gl'g	Clear	Clear		
3	$\frac{5}{2}$ c.c.	"	"	Co'gl'g	Clear'g	"	"		
4	$\frac{7}{2}$ c.c.	"	Co'gl'g	Clear'g	Clear	"	"		
5	$\frac{9}{2}$ c.c.	"	"	"	"	"	"		

Series 6. Hydrant Water. December 28, 1884.
Precipitant, Alum. (Ammonia.)
1 c.c. of the Solution contained 0.066 G. $(H_4N)_2Al_2 4SO_4 24H_2O$.

0	0 c.c.	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	9.9	
1	$\frac{1}{2}$ c.c.	"	"	"	Co'gl'g	Op'l'nt	Op'l'nt		
2	$\frac{2}{2}$ c.c.	"	"	"	Clear'g	Clear	Clear		
3	$\frac{3}{2}$ c.c.	"	"	Co'gl'g	Flocky	"	"		
4	$\frac{4}{2}$ c.c.	"	Co'gl'g	Clear'g	Bright	Bright	Bright	10.7	
5	$\frac{5}{2}$ c.c.	"	"	"	"	"	"	11.4	

Series 7. January 5 corrorborates Series 6.

Series 8. Hydrant Water. January 10, 1885.
Precipitant Muriatic Acid.
1 Drop=0.027 G. of H Cl.
Impracticable for Potable Water—water acid.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	8.9	
1	1	"	"	"	"	Op'l'nt	Clear'g	18.1	
2	2	"	"	"	Clear'g	Bright	Bright		
3	3	"	"	Co'gl'g	"	"	"		
4	4	"	"	"	Bright	"	"		
5	5	"	"	Clear'g	"	"	"		

Series 9. Hydrant Water. January 10, 1885.
Precipitant Aluminic Sulphate, ($Al_2 3So_4 18H_2O$).
1 Drop=0.010 G. of the Crystalline Salt.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	9.9	
1	1	"	"	"	Op'l'nt	Op'ln't	Op'l'nt		
2	3	"	"	Co'gl'g	Flocky	Bright	Bright		
3	5	"	"	Flocky	"	"	"		
4	7	"	Co'gl'g	"	Bright	"	"	10.2	
5	9	"	"	"	"	"	"	10.5	

Series 10. Hydrant Water. January 10, 1885.
Precipitant Magnesian Lime, ½c.c.=0.1 G. Mg O. Ca O.
Impracticable. All the samples have a lime taste.

0	0c.c.	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow		
1	½c.c.	"	"	"	Co'gl'g	Op'l'nt	Op'l'nt		
2	$\frac{3}{2}$c.c.	"	"	Co'gl'g	Clear'g	"	"		
3	$\frac{5}{2}$c.c.	"	Co'gl'g	Clear'g	"	Clear	Clear		
4	$\frac{7}{2}$c.c.	"	"	"	"	"	"		
5	$\frac{9}{2}$c.c.	"	"	"	"	"	"		

Series 11. Substantially Series 10, repeated.

Series 12. Hydrant Water. January 17, 1885.
Precipitant Ferric Chloride Sol. Specific Gravity 1.74
1 Drop=0.030 G. of Solution.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	9.6	
1	2	"	Co'gl'g	Clear'g	Clear'g	Op'l'nt	Op'l'nt		
2	4	"	"	Clear	Bright	Bright	Bright	10.2	
3	6	"	Clear'g	"	"	"	"	12.2	
4	8	"	B'n Rd	Red'sh	Clear	Clear	"		
5	10	"	" "	"	"	"	"		

Series 13 substantially repeats series 12.

Series 14. Hydrant Water. January 24, 1885.
Precipitant Ferric Sub-sulphate Solution. Sp. G. 1.48.
1 Drop=.053G.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	9.3	1.4
6	2	"	"	"	Co'gl'g	Op'l'nt	Op'l'nt	9.9	0.5
7	4	"	"	Co'gl'g	Clear'g	Bright	Bright	12.0	0.5
8	6	"	Co'gl'g	Clear'g	"	"	"		0.3
9	8	"	Yel Rd	Co'gl'g	"	Clear	"		0.8
10	10	"	"	Yel Rd	Yel Rd	Flocky	Clear		1.5

Series 15. Hydrant Water. January 24, 1885.
Precipitant Ferric Sulphate Solution. Sp. G. 1.31
1 Drop=0.040 G.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	9.3	1.4
1	2	"	"	"		Op'l'nt	Op'l'nt		
2	5	"	"	Co'gl'g	Omit-	Bright	Bright	11.9	0.3
3	8	"	"	Clear'g	ted Sun-	"	"	14 5	
4	11	"	"	Co'gl'g	day.	Clear	"		
5	14	"	"	"		Clear'g	"		

Series 16. Hydrant Water. January 24, 1885.
Precipitant Ferric Chloride Solution. Sp. G. 1.310
1 Drop=0.045 G.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	9.3	
1	2	"	"	"	Omit'd	Op'l'nt	Op'l'nt		
2	4	"	"	Co'gl'g	"	Bright	Bright	11.2	
3	6	"	"	Clear'g	"	"	"	12.6	
4	8	"	"	"	"	Clear	"		
5	10	"	"	Co'gl'g	"	Clear'g	Clear		

Series 17. Hydrant Water.
Precipitant Dyalyzed Iron.
Useless.

0	0	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow		
1	2	"	"	"	"	Op'l'nt	Op'l'nt		
2	4	"	"	"	"	"	"		
3	6	"	"	"	"	"	"		
4	8	"	"	"	"	"	"		
5	10	"	"	"	"	"	"		

Variation of Hydrant Water in Hardness.

Dec. 18.	Rain after very dry weather ...	11.5	Degrees.
" 28.	River at flood—over 45 ft.....	9.9	"
Jan. 24.	River purified by freezing and snow.....................	9.3	"
	Maximum variation................	2.2	"

The Water of the Ohio River may vary in hardness up to 2.2 metric degrees.

Precipitant.

The available precipitants for the clarification of Potable Water as determined by this investigation, are highly concentrated solutions of the following compounds:

1. Aluminic Chloride....... Al_2Cl_6 (not examined)
2. Aluminic Sulphate............ $Al_23So_418H_2O$.
3. Alum (Ammonia)...... $(H_4N)_2Al_24So_424H_2O$.
4. Ferric Chloride .... Fe_2Cl_6
5. Ferric Sulphate...................... Fe_23So_4
6. Ferric Sub-sulphate................ Fe_4O $5So_4$

Aluminic Sulphate. (Series 9.)

50 to 100 parts by weight of Aluminic Sulphate will clarify 1,000,000 parts by weight of hydrant water in about 48 hours with an increase of hardness of from ½ to 1 metric degree.

Alum (Ammonia). (Series 6.)

100 to 150 parts by weight of Alum will clarify 1,000,000 parts by weight of hydrant water in about 24 to 48 hours with an increase in hardness of from 1 to 2 metric degrees.

Note on Aluminic Precipitants.

The Aluminic Solids set free when Aluminum Salts are used to clarify water, are so light that the precipitant remains floating in the water for a long time after treatment, and when settled slight agitation muddies the water.

These compounds must therefore be followed by filtration for the successful clarification of circulating water.

Ferric Chloride. (Series 12.)

150 to 200 parts by weight of Ferric Chloride Solution, Sp. G. 1.74 will clarify 1,000,000 parts by weight of Hydrant Water in from 24 to 48 hours with an increase in hardness of from ½ to 2 Metric degrees.

Series 16.

200 to 250 parts are required of solution, Sp. G. 1.31 and the increase in hardness is from 1 to 3 degrees.

The weaker the solution the greater the hardness imparted.

Ferric Fer Sulphate. (Series 15.)

200 to 300 parts by weight of solution of Ferric Fer Sulphate Sp. G. 1.31 will clarify 1,000,000 parts by weight of Hydrant Water with an increase of hardness of from 2 to 5 Metric degrees.

Ferric Sub-sulphate. (Series 2 & 14.)

150 to 250 parts by weight of Ferric Sub-sulphate will clarify 1,000,000 parts by weight of Hydrant Water in from 24 to 48 hours with an increase in hardness of from 1 to 3 Metric degrees.

Canal Water. (Series 1.)

100 to 200 parts by weight of Per-chloride of Iron Solution, Specific Gravity 1.74 will clarify 1,000,000 parts by weight of Canal Water in 24 to 48 hours with an increase in hardness of 2 to 3 Metric degrees.

The clarified water will contain less Iron than the turbid canal water. It will be sparkling and bright and have a degree of hardness of from 38 to 40 Metric degrees.

It can not be used for drinking or culinary purposes, but would be available for general cleansing purposes, such as street sprinkling, washing pavements and flushing gutters. If used for cleansing with the help of soap, it should be softened when clarified; otherwise it would destroy four times as much soap as the river water.

Effect of the Iron Salts on the Clarified Water.
(Series 14, 15 and 1.)

The turbid water clarified by the minimum quantity of Iron Salts necessary, contained less Iron than was in it before treatment.

Soap and Alkalies will not precipitate from the clarified water a perceptable quantity of Iron without large concentration.

General Deductions.

These experiments tend to confirm the theory of Muspratt,[1] that the clarification of water by alum is accomplished by the double decomposition of that Salt and the soluble bicarbonates, forming Aluminic Hydrate, Carbonic Acid and an amount of Sulphates of alkaline earths equivalent to the alum.

The action of other Salts of Alumina, and also of the Salts of Ferric Oxide, is probably entirely analogous, but when highly concentrated solutions of the Iron per-salts are used as precipitants, Oxyhydrates of Iron are formed of considerable weight, which fall out quickly.

When Sulphate of Ferric Oxide is used, the chemical clarification of the river water introduces into it no substance that was not there before. The entire chemical change in the water consists in the transformation of a few parts in a hundred thousand of the bicarbonates of lime and magnesia into the corresponding Sulphates, and the Sulphates thus introduced fall much below what exists in the palatable and highly relished hard water of the Limestone regions of the Ohio Valley.

So far as I know, the Per-Sulphates of Iron have not, previous to this investigation, been used for the precipitation of impurities in water.

Of the above Precipitants, the only one that seems available for use without filtration is the Subsulphate of Iron.

1. Its use is not followed by an unpleasant taste.
2. It does not introduce Iron into the clarified water.
3. The increase of hardness from its use need not exceed the natural variation of the water in hardness.
4. It introduces no new chemicals.
5. It will clarify the water without filtration.
6. It can be produced at a cost comparable with that of alum.

In view of these points, it was thought best to prepare a sample of the Salt and another series of tests to arrive at the probable cost, and also the effect on sewage impurities in the water.

1. Muspratt's Chemistry—II. Water

Dissolved in the least amount of water. Slightly Acid—hot.

1.		18.7 G. of Copperas,	Est.[1] cost in lbs.	\$.140
2.	Added	1.5 " Sul. Acid, 66 B.	" " "	.025
3.	"	1.3 " Pot. Chlorate[2]	" " "	.195
		$18.7 \times .6 = 11.2$ lbs. $Fe_4O_5SO_4$	" " "	.36
		1 lb. "	" " "	.032

There were 15 c.c. of the Solution, Sp. G. 1.64

100 Drops = 2.5 c. c. 1 Drop = 025 c.c.

$\frac{.025}{15} \times 11.2$ = Solid Salt in 1 Drop = .0187, or 1 Drop in a Liter is 18.7 lbs in 1,000,000 lbs. of water.

Series 18. Hydrant Water. March 26, 1885. Highly colored from Broken Pipes.

Precipitant Sub-sulphate of Iron Sol. Sp. G. 1.64.

1 Drop = 0.041 G., and contains 0.0187 of $Fe_4O_5SO_4$.

No. Samples	No. Drops	Effect in Given Time. At Once.	1 hr.	3 hr.	18 hr.			Harne's Ca CO_3 in 100,000	Iron. Fe in 1,000,000
0	0	Yel Bn	Yel Bn	Yel Bn	Yel Bn			9.66	0.73
1	1	Yel Rd	Yel Bn	Co'gl'g	Bright			9.63	0.15
2	2	Deeper Yel Red	Co'gl'g	Clear'g	"			10.40	0.11
3	3		"	Clear	"			11.82	0.14
4	4		"	"	"				
5	5		"	"	"				
6	6		"	Co'gl'g	Rd Fl's				
7	7		"	"	"				
8	8		"	"	"				

Effect of Clarification on the Sewage.

Supplementary table to Series 18.

No. Samples	Analyst.	Free Ammonia.	Albuminal Ammonia.	Total Solids.	Inorganic Solids.	Organic Volatile Solids.	Chlorine.	Hardness.	Date.
0	Stuntz.	0.6967	1.4098	16.00	11.80	4.20		9.66	1885. Mch. 26
1	"	0.7130	0.8390	12.85	8.25	4.60		9.63	"

1. These estimates are from Figures given me by manufacturers, for large quantities.

2. Crouch's Method—Stille and Maisch—Feri Subsulphate.

SAMPLE OF OHIO RIVER WATER.

2	Leeds.	0.0115	0.0240	16.20	9.00	7.20	0.805	6.4	1882 March
3	Stuntz.	0.0070	0.0156	15.80	11.40	4.66	1.33	8.3	1880 Nov. 1

DEDUCTIONS.

Since 1 Drop (Table, Series 18.) clarifies 1 Liter of water in 18 hours, we have the Minimum Cost of the clarification of 1,000,000 Gallons of Water as follows:

$$18.7 \times 3.2 \times 7.48 = \$4.16.$$

To this must be added the cost of dissolving the materials and running the solution into the water.

There will be introduced into the reservoir something over 200 pounds of solids for each million gallons of water.

EFFECT ON THE SEWAGE.

(Supplementary Table to Series 18.)

It will be seen that the water of Series 18 is river water containing a large amount of Sewage. (Compare samples 0 and 1 with 2 and 3.)

Taking the Albuminoid Ammonia as data for the amount of Sewage, we find it reduced in the clarified water from 1.4098 to 0.8390 parts in the 100,000, over 40 per cent.

This sample and the samples of clarified canal water will serve to illustrate the general fact that, clear water is not necessarily pure water.

WATER CLARIFIED BY FILTRATION AFTER PRECIPITATION BY ALUM.

The following experiments were made on water clarified by the process of the Hyatt Filter Company, of Newark, N. J.

The specimens were collected from the pipes of their filters in the Gibson House and in the building of the Commercial Gazette in Cincinnati.

The filters of this company are funnel shaped tanks of boiler iron, constructed so that the water led into the bottom of the tank under considerable pressure, rises several feet through a compact mixture of sand and finely crushed coke, which separates the solids held in suspension. The water on its way to the tank comes in

contact with a solid cylinder of Alum, coated on the sides with wax, to prevent its too rapid solution, and the dissolved Alum coagulates the suspended matter and causes it to combine in masses that are retained in the pores of the filter.

At intervals of about twenty-four hours the mass of sand and coke is released, and the pressure under which the filter operates causes it to rise with a boiling motion into the upper part of the tank, where the friction of the sand in boiling separates the mud deposited, and the force of the current carries it off through an overflow. The cleansed filtering material is then permitted to fall into the bottom of the tank and is ready for a second operation.

TABULATED TESTS OF WATER FROM THE HYATT FILTERS.

No	DATE. 1885.	LOCATION.	Hardness, Metric Degrees. $CaCo_3$ in 100,000 p'ts of water by weight. Hardn'ss of sample	Hardness of River Water	Gain	Appearance.	Taste.
1	January 5	Gibs'n H'se	17.9	9.8	8.1	Bright	Sl't Astr't
2	February 6	" "	10.4	9.6	.8	Ft Op'l't	Pl't Astr't
3	" 13	Com. Gaz'te	15.6	9.6	6.0	B't Op'l't	Slight
4	" 16	" "	12.	9.6	2.4	Clear	Pleas'nt

NOTE.

Samples 2 and 4 were collected immediately after putting in new cylinders of Alum before the water had attained perfect clarification.

DEDUCTIONS.

The Hyatt Filter in the four samples tested increased the hardness of the water on an average 4.3 Metric Degrees. This average is probably somewhat lower than the rate at the time of the experiments. (See note Alum.) It can be made to produce very bright and sparkling water and if the Alum used is the minimum necessary, this result may be reached without increasing the hardness more than two or three Metric Degrees.

The water required daily to wash the filter is estimated at 100 gallons or about 3,000 gallons per month. The water passing through the meter per month is 500,000 gallons. $\frac{3000}{500000}=.006$ or $\frac{6}{10}$ per cent. The Alum used is about 5 pounds daily or about 300 pounds to clarify 1,000,000 gallons of water.

The following were proposed for membership:

Dr. E. Williams,	Mrs. Dr. E. Williams,
J. O. Shiras,	Allen Collier,
Chas. L. Mills,	L. M. Petididier,
W. Snowdon Smith,	Dr. David DeBeck,
Geo. F. Card,	Dr. Sheridan C. Heighway.

The following were elected to regular membership:

Dr. Frank Hunter,	John E. Bruce,
Miss Elsie Field,	Miss Fannie Field,
Miss M. C. Collins,	Miss Helen M. Herron,
Howard Barney,	Dr. W. W. Dawson.

The Constitution, as amended and reported by the Committee on Revision, was read, section by section, and, with amendments, adopted. As by the rules it must be adopted by a two-thirds' vote at two consecutive meetings before its final adoption, the second reading was deferred till the March meeting, when the consideration of the By-Laws was also in order. As amended and adopted, it is printed at the end of this number of the JOURNAL.

The Donations for the month were announced as follows: From S. S. Bassler, "Constitution of Meteorological Society," and "Weather Bulletin" for December 1, 1869; from D. L. James, Seeds of *Menispermum Canadense*, and "American Journal of Forestry," Vol. I.; from U. P. James, Burrow of Carpenter Bee; from Dr. O. D. Norton, Tooth of Elephant; from Jos. F. James, five pamphlets, viz.: "Affinities of *Dionæ*," "Cephalopoda of Cincinnati Group," "Progress of Vegetation in Ohio Valley," "Revision of Genus Clematis," and "Remarks on Fossil Fungus, etc."; from T. H. Aldrich, "Notes on Tertiary Fossils in Alabama and Mississippi"; from the Publisher, "Hoosier Naturalist," Vol. I., No. 5; from the Smithsonian Institution Bulletins, Nos. 23, 28, 29 of U. S. National Museum, "Check List of Publications," and Nos. 39, 40 of Vol. VIII., "Proceedings of U. S. National Museum"; from Ward & Howell, Catalogues of "Casts of Fossils," "Mammals, Birds, etc.," "Comparative Osteology," "Rocks of New York System," "Minerals," and "Natural Science Bulletin," Vols. I., II. and III., No. 1; from Cincinnati Public Library, "Finding List of Books"; from John B. Clunet, Portrait of Chas. Bodman; from John H. Warder, Specimen of Albutite; from John Fulton, Johnstown, Penn., through J. H. Warder, Spec-

imens of Iron Ore, Coal, etc., from Cambria Iron Co.; from Chief Signal Officer, "Monthly Weather Review," November, 1885: from University of Vermont, "Catalogue of University": from C. L. Faber, Three Photographs of Fossils, (*Plumulites* and *Ptilodictya*); from W. J. Hoffman, pamphlet, viz.: "Reid's Account of the Indians of Los Angeles Co., Cal."; from Dr. J. S. Newberry, "Notes on Geology and Botany of N. P. R. R."; from Director of U. S. Geological Survey, "Mineral Resources of United States for 1883–'84.

MEETING OF MARCH 2, 1886.

President Harper in the chair and thirteen members present.

The Custodian announced that through Dr. O. D. Norton the Society had secured the collection of the late Prof. Edw. S. Wayne, donated by Mrs. Wayne. He also announced the formation of a section of Botany, and called attention to a collection of plants lately purchased from Mr. C. G. Pringle.

Miss Emma Frick and Mr. Geo. Peck were proposed for active membership.

The following were duly elected active members:

David DeBeck, M. D.,	S. C. Heighway, M. D.,
Geo. F. Card,	Wm. Snowdon Smith,
L. M. Petitididier,	Chas. L. Mills,
Allen Collier,	J. O. Shiras,
E. Williams, M. D.,	Mrs. E. Williams.

In accordance with the recommendation of the Executive Board, Prof. Edward. Orton was elected an honorary member of the Society.

EXTRACTS FROM MINUTES OF THE SOCIETY.

December 1st, 1885.

"Prof. Jos. F. James then moved that a committee on revision of the Constitution be appointed to report at the next meeting."

"The motion was carried and the following Committee appointed at the suggestion of members: Geo. W. Harper, Jos. F. James, J. R. Skinner, Wm. H. Fisher. Dr. W. A. Dun.

JANUARY 5th, 1886.

"The report of the Committee on the revision of the Constitution was received and read."

"It was then laid over to the next meeting for discussion and adoption."

FEBRUARY 2, 1886.

"The report of the Committee on Constitution was then taken up and Dr. Dun moved that the Constitution be taken up section by section."

MARCH 2nd, 1886.

"The Constitution as revised and as read in the minutes of the the preceding meeting was then called up and upon motion duly seconded was adopted by a rising vote of 10 yeas to 1 nay,—chairman not voting."

CONSTITUTION AND BY-LAWS

—OF THE—

CINCINNATI SOCIETY OF NATURAL HISTORY.

(As revised and adopted March 2nd, 1886.)

ARTICLE I.

The Society shall be called the Cincinnati Society of Natural History.

ARTICLE II.

Its object shall be to investigate Natural History; to carry on observations which tend to increase the sum of Scientific Knowledge; to establish a Public Museum and a Scientific Library; and to provide for the diffusion of Science.

ARTICLE III.

It shall consist of the following classes of members: First, Active members. Second, Section members. Third, Life members. Fourth, Corresponding members. Fifth, Honorary members.

ARTICLE IV.

SECTION 1. Any person shall be eligible as an active member of the Society. All classes of members, except Section members, shall be elected by ballot, after having been nominated at a preceding meeting. The affirmative votes of three-fourths of the members present shall be necessary to a choice.

SECTION 2. Any person not an active member paying five (5) dollars per annum into the Treasury of the Society, may become a Section member by election to the Section and complying with the requirements of the Section.

SECTION 3. Any person contributing fifty dollars at one time to the funds of the Society, shall become a Life member, free from assessment, on being elected in the same manner as an Active member.

SECTION 4. Any Active member who has not been in arrears for the term of twenty (20) years, becomes a Life member without further payment. Any Active member who has not been in arrears for a term of ten years, may become a Life member on the payment of twenty-five (25) dollars, and be exempt from further assessment.

SECTION 5. The nomination of Corresponding and Honorary members shall proceed from the Executive Board.

ARTICLE V.

Active and Life members only shall be entitled to vote or hold office. Section members shall be entitled to attend the meetings of the Society, to attend and take part in the discussions only of the Sections to which they may belong, enjoy the privileges of the Section, but they shall not be entitled to vote or hold office in either the Society or any of the Sections, or to receive the JOURNAL of the Society.

ARTICLE VI.

SECTION 1. The officers of the Society shall be, a President, two Vice-Presidents, a Secretary, a Treasurer, a Librarian, Curators, and four (4) members elected at large for the Executive Board, and two Trustees, as provided for in Section 3 of this Article. They shall be elected annually, at the meeting in April, and shall hold office for the term of one year, or until their successors are duly elected.

SECTION 2. The President, two Vice-Presidents, Secretary and Treasurer, and the four (4) members elected at large for the Executive Board, shall together constitute a Board for the management of the concerns of the Society not otherwise provided for in this Constitution, and be called the Executive Board. Five (5) members of this Board shall be a quorum, for the transaction of business.

SECTION 3. Two Trustees shall be elected at the next annual meeting, one of whom shall hold office for the term of one year, and the other for two years. And thereafter there shall be elected annually one Trustee, who shall hold his office for two years. And these two Trustees, together with the Treasurer of the Society, shall be intrusted with, and have charge of, all funded property of the Society, with power to sell and re-invest according to their judgment. Bonds shall be required of these Trustees in such sums and with such sureties as may be satisfactory to the Executive Board. But the Treasurer shall not be required to give bond both as Treasurer and Trustee.

SECTION 4. In case of a vacancy by resignation, removal or death, in any of the offices provided for by Section 1 of this Article, the office or offices so vacated shall be filled by the Society at its next regular meeting, notice having first been given of such vacancy.

ARTICLE VII.

Officers shall be chosen by ballot and a majority of votes shall be necessary to a choice.

ARTICLE VIII.

By-laws for the more particular regulation of the Society shall from time to time be made.

ARTICLE IX.

This Constitution may be altered or amended in any of the preceding articles by a vote to that effect of three-fourths of the members present at any two consecutive meetings of the Society, the members having first been duly notified by the Secretary of any proposed alteration, but the article which immediately follows shall be unalterable.

ARTICLE X.

The consent of every member shall be necessary to a dissolution of the Society. In case of a dissolution the property of the Society shall not be distributed among the members of the Society, but donors may claim and receive such donations as they may have made to the Museum, and the remainder shall be given to some public institution, on such conditions as may be then agreed on, and the faithful performance of such conditions shall be secured by bonds, with sufficient penalties for the non-fulfillment thereof.

BY-LAWS.

Article I.—Members.

Section 1. Nominations for active membership shall be made in writing by three members, at least one month previous to the time of election. Such nominations shall be referred to a Committee, consisting of the President, Secretary and Treasurer, who shall report upon the same before balloting. Every person elected an active member shall within six (6) months from the date of election pay into the Treasury an initiation fee of five (5) dollars, excepting ladies, who shall be required to pay three (3) dollars, and subscribe an obligation promising to conform to the Constitution and By-laws of the Society; and until these conditions are fulfilled said person shall possess none of the rights of membership nor shall said name be borne upon the roll of members. Any person elected a life member shall pay into the Treasury of the Society the sum of fifty (50) dollars within six (6) months after election, subject to exemption or reduction, according to the provisions of Section 4, Article III of this Constitution.

Section 2. Corresponding members shall consist of persons residing at a distance from the city, who may be interested in the study of natural history. or desirous of promoting the interests of the Society. Honorary members may be selected from persons eminent for their attainments in science, on whom the Society may wish to confer a compliment of respect: neither shall be required to pay an initiation fee or make any contribution.

Section 3. No person whose application for membership has been rejected, shall be again proposed within one year of the date of said rejection.

Section 4. Any member may withdraw from the Society by presenting his written resignation. and paying all arrearages due from him. Members who shall be in arrears for the dues of one year shall *not* be entitled to vote, hold office or to receive any of the publications of the Society until such arrearages are fully paid: and if not paid within one year thereafter, membership shall be forfeited.

Section 5. Members may be expelled from the Society by a vote of three-fourths of the members present at a regular meeting, written charges having been preferred, a copy of which shall be furnished the accused at least one month previous to such vote, and the accused shall have opportunity to be heard thereon.

ARTICLE II.—OFFICERS AND THEIR DUTIES.

SECTION 1. The President shall preside at the meetings of the Society, and of the Executive Board, and perform such other duties as usually pertain to the office.

SECTION 2. The Vice-Presidents shall perform the duties of the President in his absence, in the order of seniority in office.

SECTION 3. The Secretary shall record and preserve correct minutes of the proceedings of the Society, and the Executive Board, in books to be kept for that purpose; shall have the charge of all records belonging to the Society; shall notify members of their election, and committees of their appointment; shall call special meetings, when directed by the President; and shall notify all active members of all meetings, and officers of all matters which shall occur at any meeting requiring their action. He shall also conduct the correspondence of the Society, and shall keep a record thereof, shall keep the common seal, acknowledge all donations, and receive and read to the Society all communications addressed to it.

SECTION 4. The Treasurer shall have charge of all money or other property of the Society, excepting the Museum and its contents, and excepting also such property as may be placed by the Society or the Executive Board in the hands of the Trustees; shall collect all fees and assessments, and receive all donations in money which may be made to it; shall pay all accounts against the Society when the same shall be approved by a vote of the Executive Board; shall keep a correct account of all receipts and expenditures, in books belonging to the Society; and shall at each annual meeting, and at other times when required by the Executive Board, make a detailed report of the same. He shall notify members, who are in arrears, of their indebtedness to the Society, and shall report all delinquencies to the Executive Board annually.

SECTION 5. The Librarian shall have charge of the books belonging to the Society, or deposited for its use, and of the publications of the Society; he shall observe and enforce such regulations as the Executive Board shall from time to time make for the use of the books. He shall have charge of the distribution, sale and exchange of the publications of the Society, under the direction of the Executive Board.

SECTION 6. The Curators shall be *ex-officio* Chairmen of the Sections, in their respective branches of Science. There shall be one Curator for each of the following-named branches: Geology,

Entomology, Botany, Zoology, Osteology, Anthropology, Photography, Meteorology, Microscopy, Physics and Chemistry. The Curators of Geology and Zoology shall have the power to appoint sub-curators in their respective departments.

SECTION 7. The Executive Board shall control all expenditures of money, make rules for the use of the Library and Museum, and determine the duties of the Curators; and they shall have power to employ a Custodian and prescribe his duties, provided such Custodian shall not be employed for any term which shall interfere with his discharge at any time by the Board, and shall elect annually a committee of five (5) members of the Society, to be called the Publishing Committee. The Executive Board shall have full power to act for the interests of the Society in any way not inconsistent with the Constitution and By-Laws. They shall annually report to the Society the condition of the Museum and Library; and they shall elect annually a committee of three (3) active members of the Society to be called the Lecture Committee.

ARTICLE III.—ASSESSMENTS.

SECTION 1. Active members shall be subject to an annual assessment of five (5) dollars, excepting ladies, who shall be subject to an assessment of three (3) dollars, payable on the first Tuesday of each year, but no assessment shall be required of any member during the six months succeeding election.

SECTION 2. The President and Treasurer together shall be empowered to exempt (*sub silentio*) a member from assessment, when, from peculiar circumstances, they may deem it for the interest of the Society so to do.

ARTICLE IV.—LIBRARY.

SECTION 1. All members of the Society, except Section members, shall have access to, or take such books from the Library as shall be set apart for circulation. The Executive Board may, by special vote, extend the use of such books to others than members, specifying the conditions under which they may be taken.

SECTION 2. The rules and regulations of the Executive Board, for the use of the Library, shall be printed and exposed in the Library Rooms, and a digest of them affixed to the volumes themselves.

ARTICLE V.—MUSEUM.

SECTION 1. All members, and the public generally, shall have access to the Museum, at such times as the Executive Board shall determine.

SECTION 2. No specimen shall be removed from the Museum, except by order of the Society, or for the purpose of illustrating the proceedings, and in either case the Curator shall take a receipt for the same.

ARTICLE VI.—COMMITTEES.

SECTION 1. The Committee on Publication shall, from time to time, cause to be published, and superintend the publication, of such papers read to the Society, and such portions of the record of the proceedings as may seem to them calculated to promote the interests of science, so far as the funds appropriated by the Executive Board shall permit. But all papers, before being printed, shall first be read before the Society, either in full, by abstract, or by title. Active and Life members and invited guests only shall be privileged to read papers before the Society.

SECTION 2. The Committee on Lectures shall make arrangements for series or courses of Lectures.

SECTIONS 3. The President shall, at every annual meeting, appoint a committee of three, whose duty it shall be to audit the accounts of the receipts and expenditures of the Society.

ARTICLE VII.—SECTIONS AND RECEPTIONS.

SECTION 1. For the purpose of facilitating and encouraging special investigation in the several branches of Natural Science, the members may organize Sections under the chairmanship of the Curator of the special branch for which the Section is organized, upon the following conditions:

First. Such Sections must be composed only of members of the Society.

Second. They must comply with all the provisions of the Constitution of the Society.

Third. They may organize under a constitution and by laws of their own, and elect their officers, except the chairman, who is elected by the Society.

Fourth. Being an educational institution, the Society prohibits any section from engaging in any thing for money profit.

SECTION 2. Receptions for the members and invited guests may be given under the auspices of the Society.

ARTICLE VIII—MEETINGS.

SECTION 1. The regular meetings of the Society shall be held on the first Tuesday of each month. Those held in April, July, October and January shall be for the transaction of business. Those held in May, June, August, September, November, December, February and March shall be for scientific purposes. The April meeting shall be known as the Annual Meeting, at which the President shall deliver an address, the officers shall read their reports, and the officers of the Society shall be elected.

SECTION 2. Nine (9) members shall be a quorum for the transaction of business.

SECTION 3. The order of proceeding at business meetings shall be as follows:

1. Reading of Minutes of preceding business meeting.
2. Candidates for membership to be proposed.
3. Election of members.
4. Reading the Minutes of the Executive Board.
5. Business arising from the reading of Minutes of the Executive Board.
6. Unfinished business.
7. New business.
8. Scientific communications.
9. Donations.
10. Adjournment.

The order of proceeding at scientific meetings shall be as follows:

1. Reading of Minutes of preceding scientific meeting.
2. Written communications.
3. Verbal communications.
4. Candidates for membership to be proposed.
5. Election of members.
6. Miscellaneous business.
7. Donations.
8. Adjournment.

Article IX.—amendments.

Section 1. All propositions to amend these By-Laws shall be in writing, and shall not be acted upon until the next regular meeting, when a majority vote of the members present shall be sufficient to adopt.

The following were the donations for the month of March: From J. E. Bruce, six copies "Statistics of Ohio," 1884; from Kansas Historical Society, "Celebration of Quarter Centennial of Settlement of Kansas"; from Americus Symmes, "Symmes' Theory of Concentric Spheres"; from Bureau of Education, "Circulars of Information, Nos. 3 and 4, 1885"; from Chief Signal Officer, "Monthly Weather Review," December, 1885; from Cincinnati Asbestos Company, six samples Asbestos and nine specimens felting and packing; from Alfred Stoehr, Specimens of Litchi Nuts; from U. P. James, Specimen of Sandstone from Indiana; from John H. Warder, Tin Ore from Virginia; from James Ridge, Photograph of Skull; from Director of U. S. Geological Survey, "Bulletins, Nos. 15–23," of Survey; from James E. Shoenberger, Specimen of Four-legged Chick; from John F. Follett, Vol. III. of "U. S. Geol. and Geog. Survey of Territories, under F. V. Hayden"; from C. H. Walker, three Specimens of Tracks from the Connecticut Valley, lot of Minerals from various localities, Bamboo Fan, Carved Gourd Bowl, Cocoanut Fibre Cap, Cocoanut Ladle from Central America, Bark of Sequoia, Chinese Napkin, etc.

CATALOGUE OF THE MAMMALS, BIRDS, REPTILES, BATRACHIANS AND FISHES

IN THE COLLECTION OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

Compiled by JOSEPH F. JAMES, Custodian.

The following as Part III. of the general Catalogue of the Collection of the Society, embraces the mounted Mammals and Birds, the Bird-skins, the Reptiles, the Batrachians and the Fishes. The Bird-skins are indicated by the work "skin" after the name. The Reptiles, Batrachians and Fishes are, unless otherwise noted, in alcohol. The numbers appended to the names are those of the general Catalogue of the Collections—the Accession List, as it is called. Such notes are added to some specimens as are thought to be of interest or value, and these are more copious in the Catalogue of Fishes than in the other cases, partly because less is generally known of them, and partly because the material was at hand in a convenient form.

CLASS I.—MAMMALIA.

Order 1. Primates. (Monkeys.)

Family Simiidæ.
(Old World Monkeys.)

Cercocebus collaris. Collared Mangabey. No. 2724.

Cercocebus fuliginosus, Is. Geof. Sooty Mangabey. 2579, 2580.

Cercopithecus callitrichus, Is. Geof. Green Monkey. 2505, 2577.

Cercopithecus mona. Mona Monkey. 2510, 2511.

Cercopithecus rubra. Patas Monkey. 2512.

Cynocephalus annubis, F. Cuv. Annubis Baboon. 2573, 2574, 2576, 2578, 2588, 2589, 2590.

Cynocephalus babouin, Desm. Yellow Baboon. 2586.

Cynocephalus mormon, Linn. Mandrill. 2571, 2725.

Cynocephalus sphinx, Linn. Guinea Baboon. 2587.

Macacus erythræus, Schreb. Rhesus Monkey. 2507, 2584.

Macacus cynomolgus, Linn. Macaque Monkey. 2581, 2582.
Macacus nemestrinus, Linn. Pig-tailed Monkey. 2591.
Macacus niger. Black Ape. 2515.
Macacus radiatus, Shaw. Bonnet Monkey. 2583.
Semnopithecus entellus. Entellus Monkey. 2728.

Family Cebidæ.
(New World Monkeys.)

Ateles, sp. Spider Monkey. 4588.
Cebus capuchinus, Geof. Weeper Capuchin. 2508, 2509.
Cebus fatuellus, Brown Capuchin. 2727.
Cebus hypoleucus, Humb. White-throated Capuchin. 3443.
Hapale jackus White-eared Marmoset. 2513.
Hapale pencellata. Black-eared Marmoset. 2514.

Family Lemuridæ.
(The Lemurs.)

Lemur brunneus. Black-headed Lemur. 2726.

Order 2. Carnivora.
(The Flesh Eaters.)

Family Felidæ.
(The Cats.)

Felis leo, Linn. Lion. (Lioness and 2 cubs, 2519. Young lion, 2520.
Felis onca, Linn. Jaguar, 2527, 2528.
Lynx Canadensis, Raf. Canada Lynx, 3417.

Family Viverridæ.
(The Viverras.)

Genetta vulgaris, Lees. Genet. 3712.
Paradoxurus typus, Cuv. Bush Cat. 3711.
Viverra civetta. Civet Cat. 3705

Family Mustelidæ.
(The Weasels.)

Lutra Canadensis, Sabine. Otter. 2532, 2533.
Mustela Americana, Turton. Pine Marten. 3698, 3699.
Putorius ermineus, Cuv. Weasel. 3719.
Putorius foetidus, var. fura. Ferret. 3723.
Putorius vison, Gapper. Mink. 3829.

Family Melinidæ.
(The Badgers.)

Meles taxus. Badger. 3423, 3424.
Mephitis mephitica, Baird. Skunk. 2530, 2531.
Taxidea Americana, Baird. American Badger. 2529.

Family Canidæ.
(The Dogs.)

Canis lupus, Luin. Gray Wolf. 2517. White Wolf. 2518.
Urocyon cinereo-argentatus, Coues. Grey Fox. 2521, 2522.
Vulpes vulgaris. Red Fox. 2523. (with two young) 2524.

Family Ursidæ.
(The Bears.)

Ursus Americanus, L. Black Bear. 2525.
Ursus horribilis. Grizzley Bear (2 cubs). 2534.

These two cubs were born in the Zoological garden in this city, and were three days old when they died. Mr. Chas. Dury, in Volume IV of this Journal, p. 68, describes and figures one of the young of another litter similar to these. The two specimens above noted are 10¾ and 11½ inches long, respectively, and the eyes are tightly closed. In describing the specimen illustrated, Mr. Dury says, "The body was of a dusky flesh tint, thickly covered with short, stiff hair, of a dirty white color, with a broad dorsal line of ash colored hairs, from the occiput to the tail. The face was rich flesh color. The nose was reddish pink, as were also the ears. The soles of the feet were bright, carmine red."

Ursus Malayanus. Malay Sun Bear. 2526.

Family Procyonidæ.
(The Raccoons.)

Procyon lotor, Storer. Raccoon, (2 specs) 3701. Albinio, 3702.

Procyon nasua. Nose Bear. 3703, 3704.

Order 3. Pinnipedia.
(The Seals.)

Phoca vitulina, L. Hair Seal. 3633.
Zalophus Californianus, Allen. California Sea Lion. 3700.

Order 4. Ungulata.
(The Hoofed Mammals.)

Family Perissodactyla.
(The Solid Hoofed Mammals.)

Asinus (Equus) Burchelli. Burchell's Zebra. 4625.

Family Artiodactyla.
(The Split Hoofed Mammals.)

Antilocapra Americana, Ord. Prong-horn Antelope. 3736.
Axis (Cervus) maculatus. Axis Deer. 3737.
Cervus porcinus. Hog Deer. 3738. (Fawn—24 hours old.)
Ovis tragelaphus. Aoudad. 3735.
Sus plicipes, Gray. Japanese Masked Hog. 4620.

Order 5. Cheiroptera.
(The Bats.)

Family Vespertilionidæ.
(The Ordinary Bats.)

Atalapha cinereus, Coues. Hoary Bat. 3710.
Vespertilio fuscus, Beauv. Carolina or Dusky Bat. 3708, 3709.

Order 6. Insectivora.
(The Insect Eaters.)

Family Erinaceidæ.
(The Hedge Hogs.)

Erinaceus Europœus. Hedge Hog. 2730.

Family Soricidæ.
(The Shrews.)

Blarina brevicauda, Bd. Mole Shrew. 3734.

Order 7. Rodentia.
(The Gnawers.)

Family Sciuridæ.
(The Squirrels.)

Cynomys ludovicianus. Prairie Dog. 3732.
(Four Specimens.)
Arctomys monax, Gmel. Woodchuck. 3721.
(Two Specimens.)
European Marmot. 3722.

Family Castoridæ.
(The Beavers.)

Castor fiber, Linn. Beaver. 3726, 3727.

Family Saccomydæ.
(The Pouched Gophers.)

Geomys bursarius, Rich. Pocket Gopher. 3730.

Family Muridæ.
(The Mice.)

Arvicola pinetorum, LeC. Pine Mouse. 3733.
Fiber zibethicus, Cuv. Muskrat. 3713.

Family Hystricidæ.
(The Porcupines.)

Erethizon dorsatum. Canada Porcupine. 3416.
Hystrix cristata. African Porcupine. 3720.
Sphingurus mexicanus, Shaw. Mexican Tree Porcupine. 3718.

Family Caviidæ.
(The Cavys.)

Dasyprocta isthmica. Central American Agouti. 4315.
Dasyprocta punctata. Punctated Agouti. 2729.

Family Octodontidæ.
(The Hares.)

Lepus Americanus, Erxl. North American Hare. 3725.
Lepus campestris. Prairie Hare. 3724.

Order 8. Edentata.
(The Edentates.)

Family Dasypodidæ.
(The Armadillos.)

Dasypus sex-cinctus. Six-Banded Armadillo. 3706.

Order 9. Marsupialia.
(The Pouched Mammals.)

Family Didelphyidæ.
(The Opossums.)

Didelphys quica. Quica Opossum. 2731.
Didelphys Virginiana, Shaw. Virginia Opossum. 4619, 4618.
(Albino.)

Family Macropodidæ.
(The Kangaroos.)

Halmaturus, Sp. (?) Kangaroo. 4622, 4623.
Macropus giganteus. Great Kangaroo. 4625.

Family Phascolomyidæ.
(The Wombats.)

Phascolomys latifrons. Hairy-nosed Wombat. 4621.

Family Monotremata.
(The Monotremes.)

Ornithorhynchus paradoxus. Duck billed Platypus (2 skins) 4616, 4617.

Besides the two skins above noted, the Society has a skeleton of this curious animal, which recent investigation proves to be an oviparous mammal. It is becoming rarer every year.

Class II.—Aves.
(Birds.)

Order 1. Passeres.
(Passerine Birds or Perchers.)

Family Turdidæ.
(The Thrushes.)

Galeoscoptes carolinensis, Caban. Cat Bird. (In case).

Harporhynchus rufus, Caban. Brown Thrasher. 4096.

Hylocichla aliciæ. · Gray Cheeked Thrush. (Skin.)

Hylocichla fuscescens, Baird. Wilson's Thrush. 4094.

Hylocichla mustelina, Baird. Wood Thrush. (In case.

Hylocichla unalashkæ, var pallasi, Ridgw. Hermit Thrush. (Skin.)

Hylochichla ustulata, var Swainsoni, Ridgw. Olive Backed Thrush. 4093.

Merula migratoria, Sw. & Rich. Robin. (In case.)

Mimus polyglottus, Boie. Mocking Bird. (Skin.)

One of the skins of this species was taken at Madisonville, O, about 12 miles from the city, but was no doubt an escaped cage bird.

Turdus merula, L. English Robin. 4095.

Family Cinclidæ.
(The Water Ouzels.)

Cinclus Mexicanus, Swains. American Water Ouzel. (Skin.)

Family Saxicolidæ.
(The Stone Chats.)

Sialia sialis, Halde. Blue Bird. 4097.
Sialia arctica, Swains. Rocky Mountain Blue Bird. (Skin.)

Family Sylviidæ.
(The Sylvias)

Regulus calendula, Licht. Ruby-crowned Kinglet. (Skin.)
Regulus satrapa, Licht. Golden-crowned Kinglet. 4098.
Polioptila cærulea, Sel. Blue-gray Gnatcatcher. (Skin.)

Family Paridæ.
(The Titmice.)

Lophophanes bicolor, Bon. Tufted Titmouse. (Skin.)
Parus atricapillus, Linn. Black-capped Chickadee. (Skin.)
Parus Carolinensis, Aud. Carolina Chickadee. (Skin.)

Family Sittidæ.
(The Nuthatches.)

Sitta Carolinensis, Gmel. White-bellied Nuthatch. 4099.
Sitta Canadensis, Linn. Red-bellied Nuthatch. (Skin.)

Family Certhiidæ.
(The Creepers.)

Certhia familiaris, var. rufa, Ridgw. Brown Creeper. 4100.

Family Troglodytidæ.
(The Wrens.)

Anorthura troglodytes, var hyemalis, Coues. Winter Wren. (Skin.)

Cistothorus stellaris, Caban. Short-billed Marsh Wren. (Skin.)

Telmatodytes palustris, Baird. Long-billed Marsh Wren. (Skin.)

Thryothorus ludovicianus, Bon. Carolina Wren. (Skin.)

Troglodytes aedon, Veill. House Wren. (Skin)

Family Motacillidæ.
(The Wagtails.)

Anthus ludovicianus, Licht. American Titlark. (Skin.)
Neocorys spraguei, Scl. Sprague's Titlark. (Skin.)

Family Minotiltidæ.
(Warblers.)

Dendrœca Æstiva, Baird. Summer Yellow Bird. 4106.
Dendrœca audubonii, Baird. Audubon's Warbler. (Skin.)

Dendrœca cærulea, Baird. Cerulean Warbler. 4107.

Dendrœca castanea, Baird. Bay-breasted Warbler. (Skin.)

Dendrœca cærulescens, Baird. Black-throated Blue Warbler. 4108.

Dendrœca coronata, Gray. Yellow-rump Warbler. (Skin.)

Dendrœca discolor, Baird. Prairie Warbler. (Skin.)

Dendrœca dominica, Baird. Yellow-throated Warbler. 4110.

Dendrœca dominica, var albilora, Baird. White-browed Yellow-throated Warbler. (Skin.)

Dendrœca maculosa. Baird. Black and Yellow Warbler. 4109.

Dendrœca palmarum, Baird. Red-poll Warbler. (Skin.)

Dendrœca pennsylvanica, Baird. Chestnut-sided Warbler. Skin.)

Dendrœca striata, Baird. Black-poll Warbler. (Skin.)

Dendrœca virens, Baird. Black throated Green Warbler. (Skin.)

Helminthophaga celata, Baird. Orange-crowned Warbler. (Skin.)

Helminthophaga cincinnatiensis, Langdon. Cincinnati Warbler. (Skin.)

This is the only specimen of this yet taken. It was shot near Cincinnati, by Dr. F. W. Langdon, and described and figured by him in this JOURNAL, Vol. III., p. 119.

Helminthophaga chrysoptera, Baird. Golden-winged Warbler. (Skin.)

Helminthophaga peregrina, Baird. Tennessee Warbler. 4104.

Helminthophaga pinus, Baird. Blue-winged Yellow Warbler. 4105.

Helminthophaga ruficapilla, Baird. Nashville Warbler. (Skin.)

Helmitherus vermivorus, Bon. Worm-eating Warbler. 4103.

Icteria virens, Baird. Yellow-breasted Chat. 4113.

Icteria virens, var longicauda, Coues. Long-tailed Chat. (Skin.)

Geothlypis trichas, Caban. Maryland Yellow Throat. 4112.

Geothlypis Philadelphia, Baird. Mourning Warbler. (Skin.)

Mniotilta varia, Viell. Black and White Creeper. 4102.

Oporonis agilis, Baird. Connecticut Warbler. (Skin.)

Oporonis formosa, Baird. Kentucky Warbler. (Skin.)

Parula Americana, Bon. Blue Yellow-backed Warbler. (Skin.)

Perissoglossa tigrina, Baird. Cape May Warbler. (Skin.)

Protonotaria citrea, Baird. Prothonotary Warbler. (Skin.)

Setophaga ruticilla, Swains. American Redstart. 4114.

Siurus motacilla, Coues. Large-billed Water Thrush. (Skin.)

Siurus auricapillus, Swains. Golden-crowned Thrush. 4111.

Siurus nævius, Coues. Small-billed Water Thrush. (Skin.)

Wilsonia mitrata, Bon. Hooded Warbler. (In case.)

Wilsonia canadensis, Coues. Canadian Fly-catching Warbler. (Skin.)

Wilsonia pusilla, Bon. Black-capped Yellow Warbler. (Skin.)

Family Vireonidæ.

(The Vireos.)

Lanivireo flavifrons, Baird. Yellow-throated Vireo. 4123.

Lanivireo solitarius, Baird. Blue-headed Vireo. (Skin.)

Vireo Bellii, Aud. Bell's Vireo. (Skin)

Vireosylvia gilva, Cass. Warbling Vireo. (Skin.)

Vireosylvia Philadelphica, Cass. Philadelphia Vireo. (Skin.)

Vireosylvia oblivacea, Bon. Red-eyed Vireo. 4129.

Family Laniidæ.

(The Shrikes.)

Lanius borealis, Viell. Great Northern Shrike. (Skin)

Lanius ludovicianus, Linn. Loggerheaded Shrike. (Skin.)

Lanius ludovicianus, var excubitorides, Coues. White-rumped Shrike. 4124.

Family Ampelidæ.

(The Chatterers.)

Ampelis cedrorum, Baird. Cedar Wax-wing. 4122.

Ampelis garrulus, Linn. Northern Wax-wing. (In case.)

Family Hirundinidæ.

(The Swallows.)

Hirundo erythrogastra, Bodd. Barn Swallow. 4120.

Petrochelidon lunifrons, Laur. Cliff Swallow. 4121.

Progne subis, Baird. Purple Martin. (Skin.)

Stelgidopteryx serripennis, Baird. Rough-winged Swallow. (Skin.)

Tachycineta bicolor, Caban. White-bellied Swallow. (Skin.)

Tachycineta thalassina, Caban. Violet-green Swallow. (Skin.)

Family Tanagridae.

(The Tanagers.)

Pyrangra æstiva, Viell. Summer Red Bird. 4116, 4117, 4119.

Pyranga rubra, Viell. Scarlet Tanager. 4118.

Family Fringillidae.

(The Finches.)

Ægiothus linaria, Caban. Common Red-poll. 4128.

Ammodromus candacutus, Swains. Sharp-tailed Finch. (Skin.)

Astragalinus tristis, Cab. American Gold Finch. (Skin.)

Astragalinus Lawrenceii, Bon. Lawrence's Gold Finch. (Skin.)

Cardinalis Virginianus, Bon. Cardinal Grosbeak. 4134.

Cardinalis, Sp. South American Cardinal. 4135.

Carpodacus purpureus, Baird. Purple Finch. 4125, 4126.

Centrophanes Lapponicus, Caban. Lapland Longspur. (Skin.)

Centrophanes pictus, Caban. Smith's Longspur. (Skin.)

Chondestes grammica, Bon. Lark Finch. (Skin.)

Chrysomitris pinus, Bon. Pine Gold Finch. (Skin.)

Coturniculus passerinus, Bon. Yellow-winged Sparrow. (Skin.)

Calamospiza bicolor, Boss. Lark Bunting. (Skin.)

Guiraca caerulea, Swains. Blue Grosbeak. (Skin.)

Hesperiphona vespertina, Bon. Evening Grosbeak. 4139. 4140.

Junco hymalis, Scl. Black Snowbird. (Skin.)

Leucosticte tephrocotis, Swains. Gray-crowned Rosy Finch. (Skin.)

Melospiza fasciata, Scott. Song Sparrow. 4131.

Melospiza Lincolni, Baird. Lincoln's Finch. (Skin.)

Melospiza palustris, Baird. Swamp Sparrow. (Skin.)

Loxia curvirostra, var Americana, Coues. American Cross-bill. 4127.

Loxia leucoptera, Gmel. White-winged Cross-bill. (Skin.)

Passerina ciris, Gray. Painted Bunting: Nonpareil. 4133.

Passerina amœna, Gray. Lazuli Bunting. (Skin.)

Passerina cyanea, Gray. Indigo Bunting. (In case.)

Passerculus sandwichensis, var Savannah. Ridgw. Savannah Sparrow. (Skin.)

Passerella iliaca, Sw. Fox colored Sparrow. (Skin.)

Peucaea cassini, Baird. Cassin's Sparrow. (Skin.)

Pinicola enucleator, Viell. Pine Grosbeak. 4141, 4142.

Pipilo chlorurus, Baird. Green tailed Towhee. (Skin.)

Pipilo erythropthalmus, Viell. Chewink: Towhee. 4136, 4137.

Pipilo maculatus, var megalonyx, Coues. Spurred Towhee. (Skin.)

Plectrophanes nivalis, Meyer. Snow Bunting. (In case.)

Pooecetes gramineus, Baird. Grass Finch. 4130.

Rhynchophanes Maccowni, Baird. McCown's Longspur. (Skin.)

Spiza Americana, Bon. Black-throated Bunting. 4132.

Spizella domestica, Coues. Chipping Sparrow. (In case.)

Spizella montana, Ridgw. Tree Sparrow. 4150.

Spizella pusilla, Bon. Field Sparrow. (Skin.)

Zamelodia ludoviciana, Coues. Rose-breasted Grosbeck. 4138.

Zonotrichia albicollis. Bon. White-throated Sparrow. (In case.)

Zonotrichia lencophrys, Swains. White-crowned Sparrow. (In case.)

Family Icteridae.

(The Orioles.)

Agelæus phoeniceus, Viell. Swamp Blackbird. 4144.

Dolichonyx oryzivorus, Swains. Bobolink. (Skin.)

Icterus galbula, Coues. Baltimore Oriole. 4145.

Icterus spurius, Bon. Orchard Oriole. (In case.)

Molothrus ater, Gray. Cow Bird. 4143.

Quiscalus purpureus. Leicht. Purple Grackle. (Skin.)

Quiscalus purpureus, var Æneus, Ridgw. Bronzed Grackle. 4147, 4148.

Quiscalus major, Viell. Boat-tailed Grackle. (Skin.)

Scolecophagus ferrugineus, Swains. Rusty Blackbird. 4146.

Sturnella magna, Swains. Meadow Lark. (In case.)

Xanthocephalus icterocephalus, Baird. Yellow-headed Blackbird. (Skin.)

Family Sturnidae.

Acridotheus, Sp. Mino Bird. 3783.

Sturnus vulgaris, Linn. European Starling. 4115.

Family Corvidae.

(The Crows and Jays.)

Corvus frugivorus, Bartr. Common Crow. 4149.

Cyanocitta cristata, Strickl. Blue Jay. (In case.)

Pica rustica, var Hudsonica, Baird. Black-billed Magpie. (Skin.)

Family Alaudidae.

(The Larks.)

Eremophila alpestris, Boie. Shore Lark. 4101.

Family Pittidae.

(The Pittas.)

Brachyurus cucullatus. Hooded Pitta. 3782.

Family Tyrannidæ.

(The Flycatchers.)

Contopus borealis, Baird. Olive-sided Flycatcher. (Skin.)

Contopus virens, Caban. Wood Pewee. 4151.

Epidonax acadius, Baird. Acadian Flycatcher. (Skin.

Epidonax flaviventris, Baird. Yellow-bellied Flycatcher. (Skin.)

Epidonax minimus, Baird. Least Flycatcher. (Skin.)

Epidonax pusillus, var Traillii, Baird. Traill's Flycatcher. (Skin.)

Milvulus forficatus, Swains. Scissor-tailed Flycatcher. (Skin.)

Myiarchus crinitus, Caban. Great Crested Flycatcher. (Skin.)

Sayornis fuscus, Baird. Phoebe Bird; Pewee. (Skin.)

Sayornis nigricans, Bon. Black Pewee. (Skin.)

Tyrannus Carolinensis, Temm. King Bird; Bee Martin. (In Case.)

Tyrannus verticalis, Say. Western King Bird. (Skin.)

Tyrannus vociferans, Swains. Cassin's King Bird. (Skin.)

Order 2. Picariæ.

(Picarian Birds.)

Family Trochilidæ.

(The Humming Birds.)

Trochilus colubris, Linn. Ruby-throated Humming Bird. 4152.

Calypte annæ, Gould. Anna's Humming Bird. (Skin.)

Selasphorus rufus, Aud. Rufous Humming Bird. (Skin.)

Family Cypselidæ.
(The Swifts.)

Chætura pelagica, Baird. Chimney Swift. (Skin.)

Family Caprimulgidæ.
(The Goat Suckers.)

Antrostomus Carolinensis, Gould. Chuck Will's Widow. (Skin.)

Caprimulgus vociferus, Bon. Whip-poor-will; Night Jar. 4630.

Chordeiles popetue, Baird. Nighthawk. (Skin.)

Phalænoptilus Nuttalli, Ridgw. Poor-will. Skin.)

Family Picidæ.
(The Woodpeckers.

Centurus Carolinus, Bon. Red-bellied Woodpecker. (Skin.)

Colaptes auratus, Swains. Yellow-shafted Flicker. 4156.

Colaptes auratus, var. Mexicanus, Ridgw. Red shafted Flicker. (Skin.)

Hylotomus pileatus, Baird. Pileated Woodpecker, 4153.

Melanerpes erythrocephalus, Swains. Red-headed Woodpecker. (Skin.)

Picus pubesceus, Linn. Downy Woodpecker. 4154.

Sphyrapicus varius, Baird. Yellow-bellied Woodpecker. 4155.

Family Alcedinidæ.
(The Kingfishers.)

Ceryle alcyon, Boie. Belted Kingfisher. 4396.

Family Cuculidæ.
(The Cuckoos.)

Coccyzus Americanus, Bon. Yellow-billed Cuckoo.

Coccyzus erythropthalmus, Baird. Black-billed Cuckoo. (Skin.)

Geococcyx Californianus, Baird. Road-runner; Chaparral Cock. 2700.

Order 3. Psittaci.
(The Parrots.)

Family Psittacidae.

Conurus Carolinensis, Kuhl. Carolina Parakeet. (Skin.)

Conurus leucotis. Brazilian Parrot. 4157.

Conurus sp. Parrot. 4159

Melopsittacus undulatus. Grass or Shell Parokeet. 4160.

Rose-throated Parrot. 4626.

Family Rhamphastidae.

(The Toucans.)

Ramphastos carinatus. South American Toucan. 3697.

Order 4. Raptores.

(Birds of Prey.)

Family Strigidae.

(The Owls.)

Aluco flammeus, var Americanus, Ridgw. American Barn Owl. (Skin.)

Asio acciptrinus, Newton. Short-eared Owl.

Bubo Virginianus, Bon. Great-horned Owl. 3425, (young) 3449, 4168, (adults).

Glaucidium gnoma, Wagl. California Pigmy Owl. 4167.

Scops asio, Bon. Little Screech Owl. (Skin.)

Strix nebulosa, Forst. Barred Owl. 4629.

Speotyto cunicularia, var. hypogæa, Ridgw. Burrowing Owl. (Skin.)

Family Falconidae.

(The Falcons.)

Accipiter Cooperi, Bon. Cooper's Hawk. 4627.

Accipiter fuscus, Bon. Sharp-shinned Hawk. (Skin.)

Æsalon columbarius, Kaup. Pigeon Hawk. (Skin.)

Aquila chrysaetus, var. Canadensis, Ridgw. Golden Eagle. 4164.

Buteo Cooperi, Cass. Cooper's Hen Hawk. (Skin.)

Buteo lineatus, Jard. Red-shouldered Hawk. 4166.

Buteo Pennsylvanicus, Bon. Broad-winged Hawk. (Skin.)

Buteo Swainsoni, Bon. Swainson's Hawk. (Skin.)

Circus hudsonius, Viell. Marsh Hawk. 4165.

Elanus glaucus, Coues. White-tailed Kite. (Skin.)

Haliaeetus leucocephalus, Savig. Bald Eagle. 4161. (Adult.) 4162, 4163, (Young).

Family Cathartidae.

(New World Vultures.)

Cathartes aura, Illig. Turkey Buzzard. (Skin.)

Catharista atrata, Less. Black Vultures: Carrion Crow. (Skin.)

Hierofalco Mexicanus, var polyagrus, Ridgw. Prairie Hawk. (Skin.)

Pandion Haliæetus, var Carolinensis. Ridgw. Osprey: Fish Hawk. 3739.

Tinnunculus sparverius, Viell. Sparrow Hawk. (Skin.)

Order 5. Columbæ.
(The Doves.)

Family Columbidæ.
(The Doves.)

Ectopistes migratoria, Swains. Passenger Pigeon. 4304, 4305.

Order 6. Gallinæ.
(The Gallinaceous Birds.)

Family Tetraonidæ.
(The Grouse.

Bonasa umbellus, Steph. Ruffled Grouse. (Skin.)

Cupidonia cupido, Baird. Prairie Hen.

Lagopus albus, Aud. Willow Ptarmigan. (Skin.)

Pediœcetes phasianellus, var Columbianus. Coues. Common Sharp-tailed Grouse.

Family Phasianidæ.
(The Pheasants.)

Euplocomus nycthemerus, Silver Pheasant. 4301.

Phasianus colchichus, English Pheasant. 4302.

Family Perdicidæ.
(The Partridges.)

Callipepla squamata, Gray. Scaled Quail.

Lophortyx Californica, Bon. California Quail.

Lophortyx Gambeli, Nutt. Gambel's Quail. (Skin.)

Oreortyx picta Baird. Mountain Quail. (Skin.)

Oreortyx picta, var plumifera, Ridgw. Plumed Quail.

Ortyx Virginiana, Bon. Bob-white: American Quail.

Order 7. Herodiones.
(The Herons and Starks.)

Family Ardeidæ.
(The Herons.)

Ardea Herodias, Linn. Great Blue Heron. 3747, 3748.

Ardetta exilis, Gray. Least Bittern. 3757.

Botaurus lentiginosus, Steph. American Bittern. 3752, 3753.

Butorides vires cens, Bon. Green Heron. (Skin.)

Florida cærulea, Baird. Little Blue Heron. 3751.

Herodias alba, var egretta, Ridgw. American Egret. 3749, 3750.

Nyctiardea grisea, var nævia, Allen. Black-crowned Night Heron. 3754.

Family Ibididæ.
(The Ibises.)

Endocinus ruber, Wagl. Scarlet Ibis. 3418.

Order 8. Limicolæ.
(The Shore Birds.)

Family Strepsilidæ.
(The Turnstones.)

Strepsilas interpres, Illig. Turnstone. (Skin).

Family Charadriidæ.
(The Plovers.)

Ægialitis semipalmata, Caban. Semipalmated Plover. (Skin.)

Charadrius dominicus, var fulvus, Ridgw. Pacific Golden Plover. (Skin.)

Oxyechus vociferus, Reich. Killdeer. (Skin.)

Squatarola helvetica, Cuv. Black-bellied Plover. (Skin.)

Family Scolopacidæ.
(The Snipe.)

Actodromas fuscicollis, Ridgw. Bonaparte's Sandpiper. (Skin.)

Actodromas maculata, Coues. Pectoral Sandpiper. 3774. 3775.

Actochromas minutilla, Bon. Least Sandpiper. 3778.

Calidris arenaria, Illig. Sanderling. (Skin.)

Ereunetes pusillus, Cass. Semipalmated Sandpiper. (Skin.)

Gallinago media, var Wilsoni, Ridgw. Wilson's Snipe. (Skin.)

Limosa fedoa, Ord. Marbled Godwit. 4309.

Micropalama himantopus, Baird. Stilt Sandpiper. (Skin.)

Macrorhamphus griseus, Leach. Gray Snipe: Red-breasted Snipe. 3779.

Numenius borealis, Lath. Eskimo Curlew. 3780.

Pelidna alpina, var Americana, Cass. Red-Backed Sandpiper. (Skin.)

Philohela minor, Gray. American Woodcock. (Skin.)

Rhyacophilus solitarius, Cass. Solitary Sandpiper.

Symphemia semipalmata, Hartl. Willet. 3776. 3777.

Totanus flavipes, Viell. Yellow Legs. 4314.

Totanus melanoleucus, Viell. Greater Yellow Legs: Telltale. (Skin.)

Tringa canutus, Linn. Robin Snipe: Knot. (Skin.)

Tringoides macularius, Gray. Spotted Sandpiper. (Skin.)

Family Phalaropodidæ.
(The Phalaropes.)

Phalaropus fulicarius, Ban. Red Phalarope. (Skin.)

Family Recurvirostridæ.
(The Avocets.)

Recurvirostra Americana, Gmel. American Avocet. (Skin.)

Order 9. Alectorides.
(The Cranes and Rails.)

Family Rallidæ.
(The Rails.)

Fulica Americana, Gmel. American Coot. 3784.

Gallinula galeata, Bon. Florida Gallinule. 4308.

Porzana Carolina, Baird. Sora Rail. 3773.

Porzana noveboracensis, Baird. Little Yellow Rail. 3771. 3772.

Rallus elegans, Aud. Red-breasted Rail. 3770.

Rallus Virginianus, Linn. Virginian Rail. 3769.

Family Aramidæ.
(The Limpkins.)

Aramus pictus, Coues. The Limpkin. (Skin.)

Family Gruidæ.
(The Cranes.)

Grus Americana, Temm. Whooping Crane. 3419.

Grus Canadensis, Temm. Sandhill Crane. 3746.

Order 10. Lamellirostres.
(The Anserine Birds.)

Family Anatidæ.
(The Ducks.)

Anas boscas, Linn. Mallard. (Skin.)

Anas obscura, Gmel. Black Duck. (Skin.)

Aix sponsa, Boie. Wood-duck; Summer Duck. 3767, 3768.

Anser albifrons, var Gambeli, Coues. American White-fronted Goose. 3666.

Aythya Americana, Bon. Red-head Duck. 4311.

Bernicla brenta, Steph. Brant. 3758.

Carinia moschata. Muscovy Duck. 3740.

Clangula albeola, Steph. Butter Ball; Bufflehead. 3763. 3764.

Clangula glaucium, var. Americana, Ridgw. American Golden-eye. 3766.

Dafila acuta, Bon. Pintail Duck. 4303.

Erismatura rubida, Bon. Ruddy Duck. 4312.

Fulix affinis, Baird. Little Blackhead. (Skin.)

Fulix collaris, Baird. Ring-billed Blackhead Duck. 4310.

Lophodytes cucullatus, Reich. Hooded Sheldrake. 4307.

Mareca Americana, Steph. Baldpate. 3759, 3760, 3761.

Mergus merganser, var Americanus, Ridgw. American Sheldrake. (Skin.)

Mergus serrator, Linn. Red-breasted Sheldrake. 3762.

Nettion Carolinensis, Baird. Green-winged Teal. 3765.

Olor atrata. Black Swan, (Australia). 3744, 3745.

Olor cygnus, Bon. European Swan. 3742 (young). 3743 (adult).

Querquedula discors, Steph. Blue winged Teal. 4313.

Spatula clypeata, Boie. Shoveller Duck. 3741.

Family Pelecanidæ.

(The Pelicans.)

Pelecanus erythrorhynchus, Gmel. American White Pelican. (Skin.)

Order 11. Steganopodes.

(The Totipalmate Birds.)

Family Phalacrocoracidæ.

(The Cormorants.)

Phalacrocorax dilophus, Nutt. Double crested Cormorant. 3696

Phalacrocorax dilophus, var Floridanus, Ridgw. Florida Cormorant. (Skin.)

Family Plotidæ.

(The Darters.)

Plotus anhinga, Linn. Snake Bird. 3756.

Order 12. Longipennes.

(The Long-winged Swimmers.)

Family Laridæ.

(The Gulls.)

Hydrochelidon lariformis, var Surinamensis, Ridgw. Black Tern. (Skin.)

Larus argentatus, var. Smithsonianus, Coues. American Herring Gull. 3631.

Sterna antillarum, Coues. Least Tern. (Skin.)

Sterna macrura, Naum. Arctic Tern. (Skin.)

Family Procellariidae.

(The Petrels.)

Cymochorea leucorrhoa, Coues. Leach's Petrel. (Skin.)

Order 13. Pygopodes.

(The Divers.)

Family Podicipidae.

(The Grebes.)

Dytes auritus, Ridgw. Eared Grebe.

Podilymbus podiceps, Lawr. Thick-billed Grebe.

Family Colymbidae.

(The Loons.)

Colymbus torquatus, Brunn. Loon. 2569, 3630.

Family Alcidae.

(The Auks.)

Fratercula corniculata, Gray. Horned Puffin. (Skin.)

Lomvia troile, var Californica, Coues. California Guillemot. (Skin.)

Ptycorhamphus Aleuticus, Brandt. Cassin's Auk. (Skin.)

TO BE CONCLUDED.

THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. IX. CINCINNATI, JUNE 1886. No. 2.

PROCEEDINGS CINCINNATI SOCIETY OF NATURAL HISTORY.

ANNUAL MEETING, *April* 6, 1886.

In absence of the President and Vice Presidents the meeting was called to order by the Secretary, and Mr. Chas. Dury elected chairman *pro tem.*

Twenty-six members present. The minutes of the previous business meeting for January were read and approved.

The following persons were proposed for membership: Alfred Gaither, H. C. Powers, Miss Mary Magurk, Miss Ellen M. Patrick, Miss Mary L. Stettinius, Lawrence Poland, Mrs. A. T Keckeler, Miss Lily Hollingshead, Dr. E. W. Walker.

Miss Emma Frick and Mr. Geo. Peck were elected active members.

The minutes of the Executive Board for December, January and February were then read.

The reports of the officers were called for and submitted as follows:

The Secretary reported that the usual monthly meetings had been held on the first Tuesday of each month, with an average of attendance for the year of 14.6.

Twenty-one papers were submitted, nearly all of which were published in the JOURNAL. Eighty members had been elected, a larger number than in any previous year of the history of the Society. The roll of members now numbers 157 names. He also submitted a list of the life members of the Society.

In the absence of the Treasurer, Mr. S. E. Wright, his report

was read by the Custodian. The receipts for the year were reported as follows:

Balance on hand April, 1885	$646 30
Income from all sources	3,262 14
Total	$3,908 44

EXPENDITURES.

General expenses, salaries, publishing JOURNAL, etc.	$2,851 15
Attorney's fees and premiums paid	186 22
Balance on hand	871 07
Total	$3,908 44

Increase of available funds $224.07. Surplus of receipts over expenditures by the Executive Board $410.99.

The number of members fully paid up (as per list submitted)	116
Members in arrears, one year	10
" " two years	9
Resigned during the year	5
Died (Dr. W. D. Clendenin)	1

The Treasurer also submitted a list of members, with the standing of each one upon his books.

Messrs. O. D. Norton, R. H. Warder and W. H. Fisher were appointed a committee to audit the report of the Treasurer.

The Curator of Palæontology, Mr. Chas. L. Faber, reported that the collection now contains about 2,000 species, 450 of which belong to the Cincinnati group. He also made suggestions looking to a better display of the collection and requested changes in the cases of the palæonlotogical room.

Mrs. M. C. Morehead, Curator of Conchology, reported a considerable addition to the department since the previous annual meeting. Several valuable exchanges had been effected, a complete catalogue of the species in the collection prepared and printed. The purchase of 400 species of Florida shells from Henry Hemphill had been ordered. Donations of money for this purchase had been made by Messrs. T. H. Aldrich, Geo. W. Harper, J. R. Skinner, Rev. Raphael Benjamin, Chas. L. Faber, U. P. James and Mrs. M. C. Morehead, amounting to $30.00, and the Executive Board had paid the additional $20.00 to make up the price of the collection. The Curator also called for more room for the display of specimens.

Mr. Geo. S. Huntington reported additions to the Department of Entomology as follows: Burrow of Carpenter Bee, Web

of Tinea Zeæ, Wood with Sclolythus burrows. The cabinet had been thoroughly inspected and disinfected. The Custodian's Catalogue of the 300 species of Calsoptera had been printed.

The Curator of Botany, Miss Nettie Fillmore, in her report said: "The first work of the year was the papering and general refitting of the room devoted to this department. The two new cabinets ordered last year were moved into their places, and in them the Custodian has arranged the Herbaniam of the Society. A card catalogue of this has been commenced. The 400 specimens of Mexican plants recently purchased are not yet fully arranged." "Among the donations are 128 species of grasses from the Department of Agriculture; seeds, section of Bamboo, fine specimen of cork, and a large lot of botanical plates and books from Prof. E. S. Wayne's collection." A section had been organized and meetings would be held regularly till June 12th. After the summer vacation the section expected to resume work in September.

The collections of the Department of Onithology and Manunalogy were reported to be in good condition by Mr. Chas. Dury. The additions during the year were fourteen birds and one mammal.

Dr. D. S. Young, Curator of Icthyology, reported no additions during the year, but the collections in good condition, though unfavorably located for observation.

Mr. R. H. Warder reported that the Department of Anthropology had received some specimens of interest. Earthenware from E. S. Wayne's collection, specimens of mound builder relics, and implements from the shores of Lake Zurich, Switzerland, from Dr. W. A. Dun. The Curator also suggested that the Executive Board consider the advisability of appropriating a few hundred dollars for the exploration of mounds.

The Report of Dr. O. D. Norton, Curator of Comparative Anatomy, showed additions to the collections by purchase from the estate of the late Dr. Geo. Bowler: skeletons of Giraffe, Horse, Lion, Leopard, Tapir, and other osteological specimens of value. The report also stated that skeletons of all the domestic animals were desired for the collection.

Dr. Walter A. Dun, Curator of Meteorology, reported that through the kindness of Serg. P. T. Jenkins, the Signal Service Observer at Cincinnati, and Gen. Hazen, the Chief Signal Service Officer, the Society now receives the "Daily Weather Map" and "Daily Weather Bulletin, 7 a. m." A large "Symbol Map" had

also been donated to the Society A section was organized under Mr. E. S. Comings, who had "felt constrained to resign." The section hoped to arrange for the distribution of forecasts and weather signals among members, and have them displayed in various parts of the city.

Mr. Geo. Bullock, on behalf of the Photographic Section, reported verbally that the section had forty-four members enrolled; that they had expended about $575.00 in fitting up the rooms assigned to them; that they met on the first and third Thursday of the month in the evening, from November to May, and in the afternoon during the summer season. The members of the Society at large were invited to attend the meetings of the section.

The Custodian and Librarian, Prof. Jas. F. James, then read his reports, as follows:

REPORT OF THE CUSTODIAN.

CINCINNATI, April 6, 1886.

Mr. President and Members of the Cincinnati Society of Natural History:

In accordance with the usual custom your Custodian begs to present his report of the work accomplished during the year just closed, and to offer such suggestions as may be of service to the Board of Officers during the coming year.

The curators of the various departments will, I presume, acquaint the Society with the additions made during the year and the conditions of the collections under their charge, so that it remains for me to acquaint the members with the means and method of providing for the numerous accessions and the general character of the proceedings during the year. The accession book, in which is entered before being put in the cases the specimens received, was alluded to in my last annual report.* This has been continued as far as practicable during the past year, and although it does not yet include all the specimens in the collection, nor even all those received in the year, yet it has now reached No. 4,800, excluding 3,000 numbered and catalogued plants, and about 1,800 numbered and catalogued shells. The same plan is expected to be continued during the coming year, and it is hoped

*See this JOURNAL, VIII., p. 76.

that this time next year all the specimens of the collections will be catalogued, and the additions constantly be posted to date.

As a part of the work of cataloguing it has fallen upon me to arrange for publication in the JOURNAL of this Society a catalogue of the whole collection. Few have an idea of the amount of work this entails, but partial results can be seen in the last volume of the JOURNAL, where in the April number is a catalogue of the Mollusca belonging to the Society, in the July number one of the Coleoptera, and in the October and January numbers one of the Library. The publication of the Mollusca and Library catalogues has been of great benefit to the Society's collection. By means of the former have been added more than 400 species of shells (received in exchange), and by the latter at least fifty volumes of valuable scientific books. Extra numbers of these catalogues were printed and can be obtained at a small price from the Librarian.

The removal of a number of flat cases, which had been left in the building on deposit, created a hiatus which has not yet been filled. The consequence was that two cases of shells and two of Indian remains had to be packed out of sight, and these are now inaccessible. I would urge upon the Executive Board of the Society the necessity of securing other cases to take the place of those claimed by the owner, in order that the collection may be adequately displayed. In this connection I will call attention to the cases of drawers, which, upon the urgent plea of the former Curator of Palæontology and the Custodian, were procured during last summer. These cases, made after a plan submitted by myself, are of stained poplar lumber, are each twenty-eight inches high, outside measure, with a base raising them above the floor, twenty-two inches in width, and the same in depth. Each case contains six drawers, each one three inches deep, inside measure, and with a lock for securing the specimens from molestation. These cases have been filled with fossils, and answer the purpose for which they were made admirably, and as they are high enough from the floor to admit of a flat glass case being put upon them, they utilize space which would be otherwise lost. I would suggest that other cases be modeled upon these, and the bulk of the fossils and shells be herein placed, having of course a sufficient number in flat cases for an attractive display.

The want of case room for specimens has become most urgent. Those devoted to minerals are already overflowing, and yet there are several hundred requiring room. I do not find that the sug-

gestions of the last Curator of Mineralogy have been acted upon during the past year, though I think the Society would have done well to see that a collection of typical rocks, minerals and petrological specimens, such as ripple marks, mud cracks, rain drop impressions, and so on, was arranged for display. This department, too, should be made of practical use. Examples of the various forms of granite, syenite and gneiss, might have enabled the paid inspectors of our coming granite pavements to perform their work with something like intelligence.

Since my last report the room devoted to Botany has been fitted up, as your Curator of Botany will inform you, and three rooms on the first floor in the rear of the building have been given up to the Photographic Section and admirably arranged, of this the Curator of Photography can inform you, as it has been done under his supervision and that of the Secretary of the Section, Mr. E. J. Carpenter.

Two valuable donations have been received during the year which deserve special mention. One of these is a collection of fifty paintings of Fungi of North America, painted by Mrs. A. P. Morgan. They are in oil, and are accurate scientifically, and beautiful artistically. They have been framed, and now decorate the walls of our building. The other donation was one of thirty-eight photographs of Western scenery received from the United States Geological Survey. These represent views in Colorado, Utah, New Mexico and the Yellowstone region, and would be ornamental if framed and hung upon our walls, as they should be.

The collections have been viewed by numbers of citizens and strangers, and have been used to a certain extent by the schools, but not so freely as in previous years, because, perhaps, the teachers have not taken the pains to come with the scholars. But on two occasions during the year there was an especially large number of visitors and guests of the Society. One of these occasions was the celebration of the birthday of Louis Agassiz on May 28th. On this occasion Dr. James A. Henshall read by invitation a eulogy on Agassiz which was afterward printed in full in the JOURNAL of the Society.* At the conclusion of the reading of this paper and of a poem by Mrs. R. Murdoch Hollingshead, the company spent a pleasant hour in examining the objects exhibited under a number of microscopes loaned by the Society members and others.

*Vol. VIII., p. 120, July, 1885.

The other occasion was on December 15th, when invitation cards were issued for a microscopical exhibition in the Society lecture room. Some seventy-eight microscopes were on the tables, and many interesting objects were shown. Among them was a living Hydra, exhibited by Mr. Geo. B. Twitchell, the circulation of blood in a frog by Dr. Walter A. Dun, section cutting by Dr. Allen, of Glendale, and many others. The company gathered together expressed themselves highly gratified, and the Society can be sure that receptions and exhibitions of this kind are of great importance in keeping it before the public, as well as enabling the citizens to know of the existence of our institution.

The feature of the past year, however, which has been most prominent in the work, has been the series of lectures given under the Society's auspices. The first course given was one on Practical Analytical Botany, for the benefit of the teachers of the public schools especially. This course began April 18th and continued every Saturday morning from 10 to 11 o'clock until June 20th. The average attendance was twenty, and as the accommodations were limited to twenty-five, it can be seen the lectures were appreciated. They were given by your Custodian, and were devoted to the explanation of the manner of analysis of between forty and fifty flowers.

The second course was also for the benefit of public school teachers, and was on Physiology and Hygiene, and given by Dr. Walter A. Dun. Some sixty-five tickets were issued to applicants, and the first few lectures were attended by from thirty to forty teachers. At the end of the course, however, enthusiasm slackened, and from twelve to fifteen was the average number. The course began on October 3rd and lasted till December 12th, ten lectures in all, one Saturday being omitted. These lectures were illustrated by blackboard sketches, experiments and microscopic specimens.

The third and last series was the regular Popular Scientific course, which has attracted much attention and become a necessary part of the winter programme of the Society. The arrangements were made for this course by the middle of December by the Lecture Committee, and on Friday, January 8th, the first one was delivered. They followed at intervals of one week and the course was concluded on the 19th of March. The following were the subjects and the lecturers:

"Hudson's Bay and Its Territory."..MR. WM. HUBBELL FISHER.
"Ants and their Habits."..............PROF. A. D. MORRILL.
"Science in Schools."...............REV. GEO. M. MAXWELL.
"Clarification of Water."... ....PROF. C. R. STUNTZ.
"Geology of Natural Gas."............PROF. EDWARD ORTON.
"Atmospheric Electricity."...............MR. E. S. COMINGS.
"Our World a Type of Other Planets.".PROF. GEO. W. HARPER.
"Astronomical Review."............PROF. R. W. MCFARLAND.
"An Australian Fern-tree Forest."....REV. RAPHAEL BENJAMIN.
"Nebulæ and Star Clusters."............MR. WM. H. KNIGHT.
"Experiments in Electricity and Magnetism."
MR. GEO. F. CARD.

Such was the interest taken in these lectures that on most occasions there was standing room only to be had. The lecture room was not large enough to hold the audiences. On two occasions, viz: "The Geology of Natural Gas" and "Experiments in Electricity," there seemed to be so much interest manifested that College Hall was secured, and on both nights the hall was filled with an interested audience. The good which these evening lectures has done the Society is not to be estimated, for while no one can tell the indirect advantage, the direct good to the Society has on many occasions been plainly manifested.

The difficulty experienced in seating the audiences gathered in our own lecture room has forced upon the attention of the members a fact which has long been patent to a few, namely, the necessity for a larger room. The present room is large enough for a comfortable reading, reception and library room, but it is totally inadequate for lectures of a popular scientific nature. Were it three times as large there would be little difficulty in filling it at our evening lectures; and although the matter was spoken of at some meetings last year and nothing was done, it behooves the members of the Society and of the new Executive Board as our managers, to take immediate steps toward an enlargement of our building. We have still some unoccupied ground, and it has been estimated that at a sum not to exceed seven or eight thousand dollars an addition could be made to our present quarters which would give room for the increase of our museum, and give us a good sized lecture hall, room sufficient for several years to come. There is already in the hands of the Treasurer a nucleus for a building fund, and if some of the wealthy men of our city would give but a fraction of what has

been and is being put into the Cincinnati Museum we would be in position to make ourselves much more useful than heretofore. This is the greatest need now of the Society, and the watchword and rallying cry of members and officers should be

"A new building and more room."

All of which is respectfully submitted,

JOS. F. JAMES, Custodian.

REPORT OF THE LIBRARIAN.

CINCINNATI, April 6, 1886.

Mr. President and Members of the Cincinnati Society of Natural History:

Your Librarian takes the opportunity at this the annual meeting of the Society to acquaint the members with the condition of the library at the close of the year just passed, and he takes great pleasure in presenting a favorable report.

During the year a catalogue of the books and pamphlets in the library has been printed in the JOURNAL, occupying fifty-one pages, and showing a total number of nearly 2,800 volumes and pamphlets on the shelves. Some of the last are bound, and some await collation and arrangement into volumes. Besides the printed catalogue, the card catalogue has been kept posted up to date, so that with very littletrouble it can be ascertained whether a volume wanted is in the library or not.

The additions during the year ending December 31, 1885, were 415 volumes and pamphlets. Many of these have been received in exchange for the JOURNAL of the Society, through donations were liberal. A full list of the additions was printed in the JOURNAL for January, 1886.

The exchange list of the Society has assumed considerable proportions. There are now 114 on the list, and of these ninteen have been added since the last annual meeting. From the list appended to this report it can be seen that the JOURNAL is sent to nearly all parts of the world. Most of the societies in the country that publish proceedings are on the list, as well as many periodicals of a scientific nature. The number of subscribers is necessarily small, there being at present only nine.

There have been about 120 copies distributed to members during the past year, but owing to the increase of membership this

number will probably be greater during the year to come, as 500 copies are printed of each number, there still remain about 250 for further distribution or sale.

Besides the additions made to the library by the exchange of the JOURNAL, considerable additions have resulted from the exchange of duplicates of various books which have been received, and this will probably be a source of considerable increase in the future. Of various periodicals and pamphlets accumulated, 115 volumes have been bound and placed on the shelves. This rapid increase will soon crowd the shelves and make more room a necessity, but at present there is still space at command.

The use of the library has been limited, but it is hoped that the members of the Society will soon come to realize the value of the library as one of reference and consult its books and pamphlets more frequently.

(Then follows a list of the exchanges of the Society.)

Respectfully submitted,

JOS. F. JAMES, Librarian.

The Society then elected officers for the year as follows:

President,	Dr. Walter A. Dun.
First Vice President,	Wm. Hubbell Fisher.
Second Vice President,	J. Ralston Skinner.
Secretary,	Davis L. James.
Treasurer,	S. E. Wright.
Trustees, one year,	Julius Dexter.
two years,	Reuben H. Warder.
Librarian,	Joseph F. James.

Members at large for the Executive Board:

T. H. Kelley,	Wm. H. Knight,
Rev. Raphael Benjamin,	Dr. O. D. Norton.

Curators—

Geology,	J. W. Hall, Jr.
Entomology,	Geo. S. Huntington.
Conchology,	Mrs. M. C. Morehead.
Botany,	Miss Nettie Fillmore.
Zoology.	Chas. Dury.
Osteology,	Dr. O. D. Norton.
Anthropology,	Geo. W. Harper.
Photography,	George Bullock.

Meteorology,	L. M. Prince.
Microscopy,	Geo. B. Twitchell.
Physics and Chemistry,	Prof. Thos. French, Jr.

The Secretary was instructed to convey to Gen. W. B. Hazen and Serg Jenkins, of the Signal Service, the thanks of the Society for kind assistance in procuring for the Society the Daily Weather Bulletin and Symbol Map.

Mr. R. H. Warder moved that "a committee be appointed to take such action as may be necessary to create public sentiment against the use of skins of our song birds for millinery and ornamental purposes."

Messrs. R. H. Warder, Wm. H. Fisher and Chas. Dury were appointed a committee with power to act.

The President, Dr. Dun, (who had taken the chair) said that a committee had been appointed to report upon the granite to be used in paving the city streets, and that there would be a special meeting of the Society to receive and discuss this report at an early date.

Mr. Aldrich said that Mr. Thornton Hinkle had prepared a paper on various kinds of pavements for the Literary Club, and moved that Mr. Hinkle be invited to be present at the discussion.

Mrs. Jos. F. James, Secretary of the Botanical Section, invited all members interested in Botany to attend a meeting of the section April 10, 1886, at 2 p. m.

Dr. Dun said that the special meeting spoken of above would be held April 16th.

Adjourned.

Donations were received as follows: From J. A. Townley, cone of Pinus Lambertiana, cones of Sequoia gigantea; from Am. Ornithologist's Union, two pamphlets; from Director United States Geological Survey, Fifth Annual Report; from Chas. L. Faber, three species fossils, two cases of drawers, three flat cases, one stand; from W. A. Dun, M. D., specimens Swiss Lake dweller remains, mound-builder skull, arrow points and gorget from Ohio; from United States Fish Commission Bulletin, Nos. 1, 2 and 3; from Dr. O. D. Norton nine specimens marbles; from Signal Service Officer Monthly Weather Review, January, 1886; from J. A. Lintner, Second Annual Report New York State Entomologist; from the Bureau of Education Report of Commissioner, 1883-4; from the estate of E. S. Wayne, about 100 volumes, books,

300 botanical plates, 300 species minerals, 50 specimens fossils, a lot of unbound magazines; from Division of Entomology, Department of Agriculture, Bulletin No. 11; from Dr. O. D. Norton Eaton's Botany North America; from Robt. Ridgeway Stejneger's Explorations of Commander Islands and Kamtschatka; from James W. Queen & Co. Microscopical Bulletin No. 6; from I. C. Reeve Abbreviations in the Geological Record; from Department of Agriculture, per Geo. Vasey, 128 species American Grasses.

Special Meeting Tuesday, *April* 16, 1886.

Dr. Dun presided, and Prof. Geo. W. Harper read a report upon "Granite used for paving in the city streets." The paper was followed by an interesting discussion, in which the invited guests of the Society took part. The proceedings of the meeting were fully reported with an exhaustive abstract of the paper in the daily papers of the next morning.

Scientific Meeting, Tuesday, *May* 4, 1886.

Vice President Fisher in the chair. Fifteen members present.

The minutes of the meeting for March were read and approved.

Mr. Fisher called attention to the omission of the words "of April" in Section I., Article 3, of the printed copy of the revised constitution.

Prof. Jos. F. James read a paper on the "Geology of Cincinnati."

Dr. Dun, the President, now took the chair.

Prof. Harper, the retiring President, then read his annual address.

The following persons were nominated for active membership: Miss M. Therese Davis, Miss Katharine M. Lupton, Mr. and Mrs. R. F. Leaman, Mr. Wm. Gibson, Miss Mary Osborn, M. D., Miss Ida Murdoch, Mr. Chas. Goepper.

Members were elected as follows: Miss Ellen M. Patrick, Miss Mary E. Magurk, Miss Mary Stettinius, Miss Lily Hollingshead, Mrs. A. T. Keckeler, Lawrence Poland, Alfred Gaither, H. C. Powers, Dr. E. W. Walker.

The Custodian announced that a case of minerals showing granites and their constituents had been prepared for exhibition in the Chamber of Commerce.

Mr. W. H. Fisher reported verbally on behalf of the Auditing Committee. (The report in writing was afterwards filed with the Secretary).

President Dun said that a class would be organized at an early day to study the weather under Mr. S. S. Bassler.

The Botanical Section showed a collection of native and hardy exotic plants in blossom, in all about eighty species.

Members were invited to attend a meeting of the Photographic Section on Thursday, May 6th, at 3 p. m., to examine a series of lantern slides.

Adjourned.

Donations were announced as follows: From Chief Signal Service, Weather Review, February, 1886; from Geo. J. Hinde, one pamphlet; from P. Herbert Carpenter, Review of Fossil Crinoids; from J. F. Judge, M. D., collection of shells, fossils, etc.; from A. P. Morgan, species of Polyporei of Miami Valley to illustrate articles published in the Society's JOURNAL; from Paul Mohr, sixteen (16) specimens marbles; from John H. Warder, specimen Bessemer Steel, two specimens artificial graphite.

MICROSCOPICAL EXHIBITION.

On the 30th of April a public microscopical exhibition was given at the rooms of the Society. Some twenty microscopes were exhibited by Messrs. F. Spaeth, M. A. Spencer & Co., Crocker & Co., and Dr. Marsh, as well as by members of the Society.

The objects to be seen covered almost the entire field of microscopical research. Micro organisms of disease were exhibited by Drs. Ricketts and Caldwell. Diatoms by H. C. Fithian and Dr. J. H. Hunt. Living pond life in the shape of a hydra by Dr. Hunt, and fresh-water algæ by Geo. B. Twitchell.

Dr. Taft exhibited a section of a cat's jaw, which aside from its value for study in histology, was a remarkable specimen of skillful work in preparation. The circulation of the blood in a frog's foot could be seen through Dr. Dun's microscope. Prof. James demonstrated the microscopic structure of the higher plants. In the way of accessary apparatus a new microtome exhibited by Dr. Allen, proved of great interest to all working microscopists present.

TUESDAY EVENING, *May* 25, 1886.

A special meeting was held under the direction of the Lecture Committee to receive reports of the Committee on "Destruction of Native and Song Birds." Messrs. Chas. Dury, R. H. Warder and Wm. Hubbell Fisher read papers on the subject.*

TUESDAY, *June* 1, 1886.

President Dun in the chair. Twenty members present.

The minutes of the preceding meeting for May were read and approved.

Dr. F. W. Langdon read a paper on "The Destruction of our Native Birds."

Mr. Chas. Dury exhibited a specimen of a hybrid duck—a cross between the Mallard and Pin-tail.

Mr. Dury also read several notes upon the disappearance and growing variety of wild pigeons, cormorants, quail and birds generally. He did not agree with Dr. Langdon's conclusions, and thought that the Doctor had underestimated the destruction of birds for millinery purposes. The disappearance of the wild pigeon was directly due to man and not to the scarcity of food or the destruction of forests.

Dr. Langdon said that his paper was chiefly written to protest against what seemed to him an undue exaggeration of the influence of man in destroying song birds. The growth of cities drives birds away from only small localities. That the United States will ever be without song birds is too much to say. Man is not the principal factor in nature. Species have appeared and disappeared long before he appeared upon the field of action. The work of the paleontologist shows that many have become extinct through wholly natural causes. These causes still operate, and man can change them but little, if at all. The ivory-bill wood pecker, cited by Mr. Dury, was always a rare bird. It had disappeared from our locality, but man was not directly responsible for its extinction. A law higher than man governs the destruction of species. The offer of $100,000 could not extirpate the English sparrow in the State of Ohio.

Prof. J. F. James said that the inhabitants of foreign countries were deserving of consideration as in the matter of destruction of

*Abstracts of these papers, and that of Dr. Langdon, read June 1st, will appear in another place in the JOURNAL.

bird life for ornament. The whole world is interested. The fact that tropical birds are more commonly used for ornament did not change our obligation to desist from encouraging the destruction of birds from whatsoever a source the supply of ornaments may be derived.

Mr. J. R. Skinner asked if there was any perceptible decrease in the numbers of robins, warblers and thrushes.

Mr. Dury said he thought there had been no decrease; that they had increased in numbers in some localities, as far as he had observed.

Dr. Langdon said he had heard two wood thrushes in song in Avondale but a short distance from Main avenue.

Dr. Dun said he was glad to hear from Dr. Langdon. Every question had two sides, and it is well to consider them. The mortality of man in our city is as great as that in the bird world, according to the figures given by Dr. Langdon. Fish have been saved from extinction by the fostering care of the State through its fish commission. Cannot similar work be done for the birds.

The following papers were read by title: "On the Making of Lantern Slides," by E. J. Carpenter, read originally before the Photographic Section, and now presented to the Society. "The Tertiary Fauna of Newton and Wautubbee, Miss.," by Otto Meyer and T. H. Aldrich.

Prof. J. F. James read a short paper on "Recent Synomyms in the Paleontology of the Cincinnati Group."

Messrs. H. P. Piper and Harry W. Brown were nominated for active membership. The Executive Board proposed the name of Prof. R. W. McFarland for honorary membership.

The following persons were elected for active members: Wm. Gibson, Mr. and Mrs. R. F. Leaman, Miss Mary E. Osborn, M. D., Miss Ida Murdoch, Miss Katharine M. Lupton, Mr. Chas. Goepper, Miss M. Therese Davis.

The resignation of Thos. French, Jr., Curator of Chemistry and Physics, was received and accepted.

A specimen from Idaho, said to be an "Agate plant," was referred to Mr. Geo. B. Twitchell, Curator of Microscopy, for report.

A communication addressed to the President from V. Lieutamd, offering to sell to the Society an ancient inscribed stone, was received and referred to the Executive Board.

The report of the Curator of Mineralogy was read and accepted.

By motion, duly seconded and carried, Dr. O D. Norton was made a committee of one to present the thanks of the Society to Mrs. E. W. Wayne for the generous gift to its museum of her late husband's collection of minerals and natural history specimens.

The Society then adjourned.

The donations for the month were as follows; From E. O. Ulrich, contributions to Am. Paleontology, vol. 1, May, 1886; from the Division of Entomology of the Department of Agriculture, Bulletins Nos. 8 and 11; from Yale College, Report of Observatory, 1884-85; from Chief Signal Officer, Weather Review, March, 1886; from Smithsonian Institution, Report 1884; from Carlos Shepard, skull from mound on Big Miami; from U. P. James, stem of Aralia spinosa; from Jacob S. Burnet, specimen of Belostoma grandis; from Mrs. U. P. James, larvæ of beetles; from Mrs. M. Cassily, three specimens coccoons Cecropia Moth; from John C. Branner, M. D., pamphlet on Glaciation of Wyoming and Lackawanna Valleys; from E. D. Cope, three pamphlets; from United States Geological Survey, Bulletins Nos. 24, 25 and 26; from Chas. E. A. Ryder, wasp's nest from Buenos Ayres; from Dr. O. D. Norton, accretion from sparks in sawing steel; from Zoological Garden, one Lop-eared Rabbit, one Barred Owl, one Black Howling Monkey.

ANNUAL ADDRESS

BY PROF. GEO. W. HARPER. (Read May 4, 1886.)

The large increase in the membership of the Society during the past year, the many and valuable additions to our library and museum, and the present healthy condition of our finances, are not only evidences of present prosperity, but are omens of good in the future. This flourishing condition of our Society should be a source of gratification not only to every member, but to every lover of science in our city, but we must not forget that this substantial growth brings with it increased responsibility.

Within the near future several questions must be settled, questions of great interest not only to our city but to the cause of science in general. Prominent among these questions is, the future location for this Society. Large and valuable private collections are awaiting the decision of this question. Our rooms are already over-crowded, and many valuable specimens are relegated to dark corners where they can not be seen to advantage. It is true that the present building might be enlarged so as to cover the entire lot, but the relief would be but temporary, for in a very few years we would need additional room.

It is quite plain that at an early day we will be compelled to remove from our present location, and any move is likely to be a permanent one. Hence the question, where? should be carefully considered and wisely settled.

The great cost of a suitable lot and the question of cleanliness are two insuperable objections to any location within the limits of the lower levels of our city. If, then, we must go to the hill tops, there are only two localities eligible—Burnet Woods and Eden Park. In both a site could be selected high and isolated, so as to avoid a large percentage of the dust and smoke, so detrimental to fine collections, within the heart of our city.

Between these two locations the preference should be given to Eden Park, as it will soon be very accessible, having two cable lines connecting it with the center of the city, and because there is already located there a museum of art, and this would become doubly attractive if it were a museum of science as well as of art. In other cities where the great mistake has been made of organizing separate museums of science and art, the two institutions have become rivals for public favor to the detriment of both.

The directors of the West Museum have already accepted in in trust a large and valuable collection of ancient Peruvian pottery.

The extensive collection of minerals, fossils and archeology belonging to Paul Mohr, Esq., will be displayed in the same building.

Mr. Cleneay's numismatic cabinet, together with his unrivaled collection in archeology, will no doubt take the same direction. By this action of the trustees in furnishing room in their fire-proof building for these valuable collections in science, they have already laid the foundations of a great museum of the arts and sciences, which will either overshadow or absorb all kindred institutions in our city. If the Mechanics' Institute, the State Archeological Association, the Historical Society of Ohio, the Natural History Society of this city, and all similar institutions, while maintaining their separate organizations, were to concentrate in one building, or cluster of buildings, with a common hall for assembly purposes, they would each and all better conserve the purposes for which they were founded.

Great libraries and museums permeate with their healthful influence all grades of society. They not only attract the passing stranger but they invite permanent residents among the better class of educated and refined people, and particularly special students of science, who naturally seek homes in places where the largest facilities are afforded for study.

In a great commercial and manufacturing city competing sharply with rival cities for the trade of a wide extent of territory, it becomes necessary that our citizens be thoroughly posted in regard to the great and live questions of the day, and what can conduce to this end better than these great public institutions.

Nearly all valuable discoveries and inventions were first thought out and formulated in the busy brain of some scientist and then handed over to a practical man who never could have originated them, but who is quick to discern their practical bearing and to push them in the marts of the world for all they are worth. It is only when the enthusiast in science and the practical man of the world go hand in hand that there is real substantial progress.

Our University can never become a seat of learning in the true sense without these necessary adjuncts of the higher education. Time was when our lovers of art were compelled to live in exile in order to draw inspiration from the great art collections of

Europe, while our scientists in like manner made long pilgrimages to the great museums of Paris, of Berlin, and London, but now our home collections are exciting an interest even on the other side of the ocean.

The large and unrivaled collections made in the Bad Lands of Dacotah by Prof. Marsh for the Yale College, and the remarkable work done by Louis Agassiz and his co-laborers for the Harvard College Museum are well-known.

The growth of the American Museum, established in Central Park, New York, a few years ago, has perhaps been the most remarkable. The City of New York has so far expended over half a million towards the building, which is only about one-eighth of the intended cost when completed. This museum is maintained by a private society. It has already received the following donations, namely a conchological collection, numbering 50,000 specimens, and valued at 10,000 dollars, with a library on conchology numbering 10,000 volumes, the gift of Miss Catharine Wolfe. The Maxmilian and other collections, containing 4,000 mounted specimens of mammals, birds, etc. Collection of North American birds, 2,500 specimens, lepidoptera 10,000, beetles and insects 4,000, and over 7,000 specimens of minerals. Add to these Dr. Davis' pre-historic collection, numbering many thousands of specimens, and Prof. James Hall's large collection, containing many valuable types of silurian fossils, described by him and others, which was purchased for $6,500, and presented to this same museum. The above are only a part of the many donations made to this museum since its foundation.

The Academy of Natural Sciences of Philadelphia has also grown enormously within the past few years. Among its many valuable acquisitions is the collection of Crania, numbering over 1,300 specimens, begun by the late Dr. S. G. Morton, and said to be the finest in the world.

There seems to be no good reason why the Queen City of the West should not have a great museum of the sciences as well as of the arts. The enterprise and generosity of our citizens in the past is an assurance that all the money needed to accomplish this object will be furnished as soon as our Society has proven itself competent and worthy of such a trust.

THE GEOLOGY OF CINCINNATI

By Prof. Joseph F. James,

Custodian of Cincinnati Society Natural History.

(Read May 4, 1886.)

The City of Cincinnati occupies one of the most interesting geological positions on the North American Continent. As has been truly expressed, the hills of Cincinnati are counted as classical ground by geologists of all lands, and "Sir Chas. Lyell said, after visiting the hills and looking over the collections that had been made of their treasures, that there was no other locality known in the world where so large a number and so large a variety of well preserved Lower Silurian forms could be so easily procured."*

But beside the fossil treasures which exert so potent an influence over the minds of collectors, there are other matters of great interest connected with the ground upon which the city stands, and by which it is surrounded. Few attempts have been made to study the surface geology of the vicinity. The chapters in the Ohio Geological Survey† contain about all that has been written on the subject, so that it is by no means exhausted. To elucidate some of the problems relating to the geology and topography of Cincinnati and its vicinity is the object of the present paper.

That subject of much controversy among geologists, viz: whether the rocks as exposed in our neighborhood should be known as the Hudson River and Utica slate, or as the Cincinnati Group, will detain us but a short time. Prof. James Hall, as the leader among Eastern geologists, insists that the rocks are of the same age as the Hudson River Group, and should be so called. Dana follows him, as, in fact, do most of the Eastern geologists. But Newberry, Orton, Meek and Worthen, four geologists who have given much attention to the exposure in Southwestern Ohio, insist that the rocks are not equivalent to either the Hudson River or the Utica slate; but that there is a commingling of Trenton, Hudson River, Utica Slate, and some peculiar fossils found in none of these which entitle the exposure to a distinct name. and so they call it the Cincinnati Group. It seems well chosen and

*Ohio Geol., I., p. 385.

†Vol. I., chaps. 4, 13, 14 and vol. II., parts of chap. 30.

worthily applied; for, although rocks of the same age are found in other states and other localities in Ohio than about Cincinnati, yet it is here that they are best exposed; here where most of the work has been done, and the name of Cincinnati Group will be adopted in this paper.*

But leaving this to be discussed by others, let us proceed with the subject in hand. No matter what name may be given to the particular group, no one is prepared to deny that it belongs to that great series of sedimentary strata known as the Lower Silurian. Rocks having the same general characters, and often with the same varieties of animal life, are exposed to the east as far as Waynesville, to the north as far as Dayton, and on the west to Madison, Indiana, reappearing in places in Illinois. While to the south it extends to near Frankfort, Kentucky, reappearing at Nashville, Tennessee.

Like all other fossil-bearing rocks, those of the Cincinnati Group are sedimentary in their origin, and were originally derived from the wearing away of lands either near or remote. In the present instance, all the sediment was derived from high mountains which existed far north of Lake Erie, forming part of the ancient Archean Continent. At this time there stretched a deep sea over the earth south of the 45 deg. of north latitude, and upon the floor of this ocean the sediment from the Canadian mountains was deposited in immense sheets, aggregating more than six thousand feet, and filled with a most wonderful profusion of animal remains.

The period of time required for the deposition of this sediment was immense, and is not to be readily calculated. But the time at last came when certain elevatory forces began to act, and there was at last raised above the sea level an island, extending from somewhere near the center of western Ohio, south to the center of Kentucky, while near the same time large tracts appeared above the water in northern and eastern New York, in Wisconsin, Illinois, Minnesota, and small outlyers in Missouri, Arkansas and Tennessee.

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*It may be well to state that some years ago (See this JOURNAL, vol. 1, p. 103) certain of the geologists and collectors of Cincinnati presented a report to this Society recommending that the term, "Cincinnati Group," be discarded in favor of that of "Hudson River Group." But since that time some of these gentlemen have reconsidered their action, and now recognize the term "Cincinnati" as more appropriate. It may be said that the majority of Western geologists recognize the term "Cincinnati," while the majority of Eastern geologists adhere to "Hudson River" and "Utica Slate."

The elevation of the land, in this vicinity at least, was very gradual, so much so that no distortions or flexures of any consequence were produced in the strata, and they rose above the surface in almost perfect horizontality, with the exception of a slight dip to east, west and north. In our vicinity there appears to be evidence of depression as well as elevation. At intervals both forces have acted. Well defined sea beaches are found at at least two horizons in this locality. One of these is at about low water in the Ohio river, and the other one at between 300 and 400 feet higher. The lower one of these beaches is characterized by a certain peculiarly waved structure of the rocks, and also by various mud cracks, tracks and markings which could only have been made and preserved near the margin of an ocean, or on absolutely exposed surfaces of land. Prof. Orton describes the appearance of the rock presented at low water mark on the Kentucky side of the Ohio river at Ludlow excellently, and I can testify that his description is accurate, as I have seen it many times. He says:* "The rocks exhibiting this (waved) structure are the most compact beds of the fossiliferous limestone. The bottom of the waved layer is generally even, and beneath it is always an even bed of shale. Its upper surface is diversified, as its name suggests, with ridges and furrows. The interval between the ridges varies, but in many instances it is about four feet. The greatest thickness of the ridge is six or seven inches, while the stone is reduced to one or two inches, at the bottom of the furrow, and sometimes it entirely disappears. The waved layers are overlain by shale in every instance. They are often continuous for a considerable extent, and in some cases the axes of the ridges and furrows have a uniform direction. This direction is south of east in the vicinity of Cincinnati, but in traversing the series, these axes are found to bear in various directions."

The shore line as here considered must, of course, have been formed at an earlier period than that at which the strata above were laid down. And during this deposition the former shore line must have been under water, and then it was that three or four hundred feet of rock were formed. Part of this time must have been a period of subsidence, at the end of which there came an upheaval, and the second shore line was formed. This beach lies between three hundred and fifty and four hundred feet above

*Ohio Geol., I., p. 377.

the first one, and is characterized by certain impressions of animal remains, worm tracks, and marks made by running water over exposed surfaces of mud. These are tolerably constant at a horizon which corresponds in a general way in various parts of the group, such as Obanyon Creek in Clermont County, and in exposures, near Lebanon, in Warren County.

All the beds which make up the deposits about the city are by no means equally rich in fossil remains. Sometimes a thick stratum is found which is absolutely barren of life; and again another will be found where remains are extremely abundant. What are known as the Eden shales, amounting to nearly two hundred feet in thickness, seem, in places, to be barren of life, although in spots fossils are found in abundance. It has been generally agreed that the bedded rocks of this vicinity were laid down in a deep sea. Now Darwin has shown that thick beds of sediment are seldom deposited except over an area of subsidence, and that it is during this period of sinking that the greatest number of species of animals are preserved. If, therefore, the theory that the epoch of the second shore line was followed by a time during which the land was gradually subsiding, then there should be some record of it preserved in the increased number of species and specimens of fossil remains. The facts known confirm this theory, as will now be shown.

From two tables of species given by Prof. Orton in Ohio Geology, vol. I., pp. 398—399, it would appear that fossils are much more abundant above the three hundred foot horizon than below it. This horizon in fact seems to be the beginning of the appearance of many forms unknown in the strata below, and the remains are much more abundant in number of specimens also. It is stated that beds are met with in the upper part of the group, sometimes five and six feet thick made up entirely of the valves of brachiopod shells. "The free valves," says Prof. Orton,* "can be gathered as perfect in form as sea shells on a modern beach, often retaining the visceral and muscular impressions with the greatest distinctness." Still another proof of the subsidence, and that, too, at a slow rate, is the occurrence at about four hundred feet above low water of about one hundred feet of rock which are almost entirely made up of almost microscopic univalve shells.

These facts show that the period of the second shore line must have been followed by a second epoch of depression, and

*Ohio Geol. I., p. 382.

during this epoch probably a thousand feet of sediment were deposited; for, although but little remains of it now, we must remember that the land has been exposed for countless ages to the degrading and denuding agents of air and water, so that at the close of this final period of subsidence came the last one of elevation, and the land rose above the surface of the water until it stood one thousand, and perhaps fifteen hundred feet above the level of the surrounding sea.

It is noteworthy that the beds of barren shales are found just below the level of the second beach, and the inference is that they were deposited at a period when the sea bottom was stationary, and that it was at the close of this period that the land appeared above the sea level. Finally, Prof. Orton says, that the Cincinnati axis underwent oscillations of level, and the facts above given tend to show plainly this was the case.

Having now discussed the aspect and geological position of the rocks found in the immediate vicinity of Cincinnati, and having seen them raised finally in perfect horizontality above the ocean level, let us examine the agencies which have been in action so long as to change in a wonderful manner the whole appearance of the surface since the time when it emerged as a long ridge with gently sloping sides above the waters.

No sooner is an area of land exposed to the atmosphere than denudation begins. There is an immediate tendency to degrade the summit to the level of the sea, and so actively is the work carried on that it is simply a question of time how soon even a high mountain range is reduced to the ocean level. The newly elevated island of Cincinnati was no exception to the general rule, and although it was not extensive enough to possess any large rivers, the ordinary aerial agencies of air and water would be sufficient to accomplish a great deal in a long period of time. A little furrow in a sloping bank, made by a rivulet, soon becomes by the addition of other rivulets a rapid torrent, and gradually increases in size, volume and power. It sweeps more and more sediment down its sloping channel, and at last casts its burden into the ocean to be there spread out in even sheets upon the ocean floor far from land.

No more striking example of the erosive power of water acting through long periods of time can be seen than in our Western territories in the great Colorado River Basin. Here the

river has excavated a channel through solid rock for hundreds of miles to a depth of from 500 to 7,000 feet. In places, over 10,000 feet of solid strata have been removed over an area of more than five hundred square miles, and all this in an arid region where the rain fall is limited in amount. The region, once an extensive plateau, is now cut up into innumerable canyons and valleys, ramifying in all directions like the veins in a leaf. In a mountainous country the corrading powers of water are correspondingly greater, and what was once a smooth mountain side will in time be cut up into ravines innumerable. Capt. Dutton in his interesting account of the Hawaiian Volcanoes* pictures what will result in the course of thousands of years were the forces now in action to continue their work. "As in every other mountainous country," says he, "the ravines would grow wider, their sloping sides would be gradually pared away, and the rocks reduced by secular decay to sand and soil. The silt would be carried off by the running streams to the ocean, and the remnants of the sloping platforms between the ravines would grow narrower until at length they were reduced to knife edges, and would still continue to dwindle in size." Again, he says:† "Whenever a great valley or gorge is eroded in a large mountain mass, the head of the valley forms an amphitheater, or series of amphitheaters, with abrupt or precipitous ravines immediately beneath the peak. In general terms, as we follow such a ravine from the plains below upward toward the summit, the grade of its bed becomes steeper to the very last. Again, where two or more mountain gorges descending on different sides of the cone reach far up toward the summit so that their upper portions are separated only by a narrow divide, then this divide will always be sharp and well preserved through all stages of erosion."

To give a few examples of the wearing powers of water in a short time, I will quote a paragraph from Dana.‡ "Lyell mentions the case of the Simeto, in Sicily. In two and a half centuries it had excavated a channel fifty to several hundred feet deep, and in some parts forty to fifty feet wide, although the rock is a hard solid basalt. He also describes a gorge made in a deep bed of decomposed rock, three and a half miles west of Milledgeville, Georgia, that was at first a mud crack a yard deep in which

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*Fifth Annual Report of U. S. Geol. Sur., p. 213.
† Ibid. p. 207.
‡ Manual of Geology, p. 647.

the rains found a chance to make a rill, but which, in twenty years, was 300 yards long, 20 to 180 feet wide, and 55 feet deep. And Liais describes a similar gorge, of twice the length, in Brazil, made in forty years."

Many other instances of the wearing away of the rocks by water might be given, but these will suffice to show that during the long periods of time that have elapsed since the Cincinnati island was first elevated above the water, there has been ample opportunity for extensive denudation, and it is no wonder that the face of the country is vastly altered. Let us now proceed to examine the situation of the city, and see if we can trace the history of the present conditions.

Such an investigation is beset with many difficulties. Not the least of these are the changes which have been wrought by the gradual growth of the city, and the encroachment upon the high ground which partly surrounds it. Laying out streets and building lots; leveling elevations, and filling valleys, tend to greatly change the aspect of the country. So that what was once rolling land becomes level; what was once the bed of a raging torrent or a gently murmuring brook, becomes a covered drain; what was once an abrupt height becomes a gentle gradient; and what was once a level plateau becomes marked by the innumerable excavations made in the process of quarrying stone. All these changes must be considered in a study of this sort, although some few reminders are often left to guide us to a correct view of what was once.

Cincinnati proper occupies an extensive plain or bottom land extending in a semi-circle, with the Ohio river on the south, and a series of elevations on the north known commonly as Mt. Adams, Walnut Hills, Clifton Heights and Roe's Hill. At the western side of the city is the extensive valley of Mill Creek, a valley several miles wide, and extending many miles to the north and northeast. Beyond Mill Creek is another elevated ridge, at the south end of which is situated the suburb of Price Hill. South of the Ohio river lie Covington and Newport, divided by the Licking river, and occupying part of the same extensive plain upon which Cincinnati is built. These two cities are encompassed on the south by a range of highland extending in a semi-circle, similar to the range on the north side of the river.

In what is now the main business part of the city, the plain has two terraces. One of these finds its level approximately

where Pearl street is laid out, and the other follows in its general direction Fourth street. Both these levels decline toward the west and northwest, and finally melt away into Mill Creek valley. Low water mark of the Ohio river is 432 feet above tide water at Albany; the Pearl street level between Broadway and Vine is about seventy feet higher, or 500 feet above tide water, and the Fourth street level is about forty feet higher.

Tell a citizen of Cincinnati that there are no hills in or about his city, and he will laugh at you; tell the same to a resident of Clifton, Walnut Hills, Mt. Auburn, or any of the so-called "hill-top" suburbs, and he may call you crazy. For they would consider it an absurdity to be told this when they must, nearly every day of their lives, be hauled up inclined planes, and carried by cable roads, or horses, 300 feet or more above the level of Fourth street. Yet to say that there is not a hill in or about Cincinnati, or even in Hamilton County, would be but telling the strict truth. There are elevations, but no true hills, for a hill is a mass of earth raised above the general level of the surrounding country. If Mount Auburn towered above Walnut Hills as high as it stands above Fourth street, and from its top one could command a view of the country far and wide, then indeed it would be a true hill. But such is well known not to be the case, and a study of our city's surroundings will reveal the real state of affairs and show its "hill-top" resorts to be the remnants of a once extensive level or nearly level plateau.

If we go to Eden Park and stand awhile on the brow of the hill beneath the shelter house, and look down upon Gilbert avenue, we note several things. Back of us are ledges of rock projecting from the bank, below us are other ledges of the same character. If we turn our eyes to the westward, across the deep valley of Deer Creek, on a level with where we stand we see another bank, out of which also project rocky ledges of the same character as those near us. Turning our gaze gradually to the north and thence to the east, we perceive one, two, three, four, similar perpendicular banks, out of which project the same kind of ledges. All these are evidently on a level, and it takes but a short time to conclude that all the ledges were once united, and formed a continous floor from where we stand across Deer Creek valley to Mt. Auburn, and up to the northward. In imagination we see the valley filled with limestone rock piled ledge upon ledge and forming a level plateau stretching away as far as the eye can see.

If we go now to the east end of Eden Park, on the steep bluff overlooking the river, we find the same rocky ledges. All along the bank, farther than we can see, it is the same, and could we look into the Kentucky banks just opposite, the same layers would be found. But before being perfectly sure of what we suspect to have been the case, let us journey to west of Clifton Heights, in the neighborhood of the great quarries. Here, better than anywere else, can be seen the evenness and regularity of these rocky ledges. Great quantities of earth have been removed and great holes have been cut into the solid limestone. Hundreds and thousands of perch of stone have been carted away to form foundation walls for innumerable buildings. If now we walk westward we find the ledge continues under our feet, and we finally pause on the brink of the precipitous bank overlooking Mill Creek. Looking again westward, the same ledges crop out of the bank. Not a doubt can now remain that there once stretched an extensive plateau from the Kentucky shore back of Dayton across what is now the Ohio valley, through Eden Park, over Deer Creek valley, through Mt. Auburn, Clifton Heights, and across Mill Creek valley to the opposite bank and far beyond. The various valleys and ravines are seen to have been excavated in this plateau, and the diversified aspect of the country is due to the erosive powers of water, acting through immense periods of time. There is one other force which has at one time had something to do with altering the appearance of the country hereabouts, and that is moving ice. When during the glacial era a large part of the North American continent was covered with an immense mass of ice, in places five, six, ten thousand feet thick, it was a powerful erosive agent. For it swept over the surface of the land, plowing it out here, filling it up there, overtopping hills, or sweeping round projecting or insurmountable points.

At the close of this period the whole face of the country bore a very different aspect from what it had previously borne. In places immense piles of debris remained, forming banks many miles long, and many feet high. When these were in the beds of former streams, it became necessary for the stream thus barred out to seek a new channel, and it varied from its former course more or less, in accordance with the amount of material left in its bed. Many streams were compelled to form entirely new channels, but others had to carve new courses only in places here and there. The Ohio river seems to be one of those placed in the latter cate-

gory, for in many places its valley is too wide and too deep to have been excavated by the volume of water now flowing at ordinary stages. In fact there seems little doubt but that the Ohio flows in a channel which was cut long previous to the glacial period. This old channel has been largely filled up, and the river now flows from thirty-five to forty feet above its ancient bed. This seems to be conclusively proven by the discovery at that depth below the present surface of the ground of an extensive bed of carbonaceous material consisting of stumps of trees, leaves, seeds, and other vegetable remains. This layer doubtless once formed a sort of bottom land, and the material overlying it must be referred to a later epoch and one which seems contemporaneous with the period of the glaciers.

This superposed material, forming in main the terrace upon which the city stands, is composed, according to Prof. Orton,* "Of distinctly stratified gravel and sand of varying degrees of fineness and purity. The gravel stones are all water-worn. In weight they seldom reach ten pounds. The upper tributaries of the Ohio supply the materials in part, but a much larger proportion in the vicinity of Cincinnati is derived from the limestone rocks of Western Ohio and the crystalline beds of Canada." "The leading facts in the structure of the terraces show that their history is not to be explained by the present conditions of the continent. They must have been formed under water at a time when the face of the country held a lower level than it does now by one hundred or more feet."

The gravel and sand of the terraces varies greatly in different quarters. In some places, as has been revealed in excavations in different quarters of the city, it is coarse and mostly composed of large pebbles mixed with a small quantity of clay and sand. Fourth street, Broadway, and many other streets are on gravelly foundations. Again, the gravel is replaced by fine sand, as for example on West Eighth street, near Mound, Vine, near Fifteenth, and others; while in still other places the subsoil is a heavy, stiff clay, very close and fine grained and exceedingly difficult to work. One pocket, as it seems to be of this material, is in the vicinity of Pike and Pearl streets. It goes by the name of "Springfield clay." It is this clay, so Prof. Orton states, which was used in paving the floor of Eden Park Reservoir. These various deposits, sometimes extremely local, show varying conditions existed; in one place a

*Ohio Geol., I., p. 431.

rapid flow of water, in another a slow and gentle movement, and in still others eddying currents which deposited the sediment in compact beds.

If the course of the Ohio river was different at one time from what it is now, the question arises, where was this previous channel? Several facts seem to point to the conclusion that in the vicinity of our city, in fact on the very site of the city itself, there was once spread out a sheet of water which assumed almost the aspect of a lake. The whole of the ground where are now standing the cities of Cincinnati, Covington and Newport, was doubtless once covered with a sheet of water whose boundaries were the Kentucky highlands on the south, the range of highlands west of Mill Creek valley on the west, and the rocks which form the base of "Indian Hill" on the east. The outlet of this sheet of water, or this lake, was not its present one, namely, past the mouth of Mill Creek, but up what is now Mill Creek valley on one side, and up the Little Miami valley and an ancient channel between Red Bank and Plainville on the other side, of what then formed an island, and which is now occupied by the suburbs of Mt. Lookout, Walnut Hills, Mt. Auburn, Avondale and Clifton. These ancient channels extended northward on the east and west of the island, and united near where Ludlow Grove now is, and thence together held their way northward to Hamilton. There they turned to the west and south, and reached the Ohio river valley as it is now, somewhere near Lawrenceburg, Indiana, by following the course now used by the Big Miami. In those ancient days a barrier of land stretched in as yet an unbroken line from Price Hill across to the Kentucky side, and this compelled the water to find an outlet by the ways we have mentioned.

It is supposed that during the glacial period, the end of an immense glacier extended south as far as the Ohio river, and at Cincinnati so completely blocked the channel as to compel the river to seek a more southern course. But at the close of the ice age, and when the glacier had melted, the river attempted to return to its former channels. Finding, however, its old bed filled with sand and gravel, the debris of the retired ice field, and finding, perhaps, also that the former impassible barrier had lost some of its height, it beat against it, gradually wore it away, and cut for itself a new channel from the mouth of Mill Creek to Lawrenceburg.

It is said that the City of Louisville stands upon part of a filled up channel of the Ohio river, and what are now the falls of the Ohio are the remains of the heavy bedded rocks cut through by the stream in its efforts to form a new channel. It is likely that the same is the case with Cincinnati. The city proper stands upon part of this filled up channel or lake bed, and the new channel of the river has cut far enough into the rocks to sweep away all obstructions and permit free passage to the stream. The remains of the barrier are found in the beds exposed near Ludlow, Kentucky, and above the Cincinnati Southern Railway Bridge (C. N. O. & T. P. R. R.), as well as in what is known as "McCullum's Riffle," a conspicuous bar in low water, a few miles below the city. No doubt that at the period when the barrier stretched unbrokenly across from Price Hill to Ludlow, and when the two previous outlets of the lake were filled with sand and gravel, the water formed a rapid for miles over this barrier. Constant attrition has worn it away, and now it has completely disappeared from the channel, and forms no obstruction to navigation such as is found at the present day at Louisville.

We have thus far traced the geological history of Cincinnati and tried to explain the reasons for its present aspect, but as yet nothing has been said of the minute topography of the city's suburbs. As, however, this paper has already reached a considerable length, the second portion of our subject must be left for another period, when I hope to have collected material to show just how the land is drained, and to point out several as yet unnoted facts in the surface geology.

[TO BE CONCLUDED.]

LANTERN SLIDES.

By E. J. CARPENTER.

(Read at meeting of the Photographic Section May 6, 1886.)

There is probably no other way in wnich a photographer can so satisfactorily show the results of his work as by projecting the views on the screen by means of the so-called magic lantern, and I find in my own experience that many who do not care for or appreciate the best results presented in the form of silver prints on paper are pleased and interested by the same views when shown on the screen. This is no doubt mainly due to the increased size of the pictures, which gives them a reality so vivid that it is not difficult to imagine that the spectator might, if so inclined, step out into the scene presented before him, and I have known children to voluntarily speak to friends whom they recognized, and whose presence seemed so real when presented in this manner.

Fortunately, the production of pictures for use with the lantern is now one of the easiest and simplest of photographic operations. Any negative that will make a passable silver print may be used, and in addition many are available, which by reason of various imperfections cannot be used at all for ordinary printing. The operation is, briefly, to make a transparent positive on glass of the proper size, usually 3¼x4 inches.

The tests of a first rate lantern slide are as follows: The image must be clear and brilliant, having contrast without harshness. The highest lights should be clear glass without a trace of silver deposit; and the deepest shadows should be sufficiently transparent to permit all detail to be seen. When the plate is laid on a white printed sheet the type should be legible through the shadows, and the lights should show no deposit.

The easiest method of making positives is to print by contact in the pressure frame just as is done in silver printing, but for this purpose it is necessary that the negatives should be of the proper size, which is not usually the case unless they happen to have been made specially for the purpose. I have often made contact positives, but only where I wished to use a small portion of a larger negative, or when the slides were to be made by copying photographs or engravings. In the latter case a small negative is made of the copy, usually on a 4x5 plate, which size is large enough to enable one to properly adjust the plate on which the positive is to be made.

If the negative to be copied is larger than the required positive, recourse is had to the camera. The negative is set up in a frame, and the camera is placed facing it in such a manner that the ground glass is parallel to and opposite the center of the negative. It is then moved back or forward until the image of the negative is of the proper size when focused. The operation of focusing is one requiring the greatest care, and is also one which does not, I am afraid, receive the attention its importance demands. Very few people have eyesight sufficiently sharp to enable them to perform this operation without the aid of a magnifying glass, and to those who think they have I would suggest to try the experiment of examining carefully with an ordinary hand microscope any lantern slides made without the use of such a glass to focus the image. The result will probably surprise them, as I will confess it did me when I compared in this way two sets of slides made from the same negatives, one lot made by using the glass to focus, and the other by unassisted, but rather more than usually keen, eyes. Among the most common faults of the various slides submitted for criticism has been this of poor focussing when making the copy. When it is remembered that the operation of once focussing will suffice for probably all the positives to be made during an afternoon or a day, it will be seen that the little time required to do it perfectly is well spent.

The best apparatus and the easiest to use for reducing negatives and making slides is the copying camera, a good specimen of which belongs to this Society. Before making the exposure, if an ordinary camera be used, it is necessary to cover over the space between the lens and the negative to be copied, so as to prevent any light from reaching the lens that does not pass through the negative. If this is not done a brilliant positive will not be obtained, because a certain amount of this extraneous light will be distributed over the sensitive plate, and cause a veiling of the high lights, which ought to be perfectly clear.

If a portrait lens be used in the copying camera, and this form of lens gives most satisfactory results, it will be necessary to stop it down considerably, though even then it will be found that the exposures are shorter than with any of the various view or group lenses. As most lantern slides are made in the winter season when the light is weak, and clouds, smoke, etc., still further impair its activity, it is a matter of some importance to have a quick-working lens.

The duration of exposure depends on so many conditions that the requirements of each plate must be determined on its own merits. Fewer mistakes in exposure will be made if before beginning operations the negatives be carefully looked over and sorted, putting together those which nearest approach each other in density, and which therefore will require approximately the same exposure. Negatives which require special treatment should also be put aside and handled together, as experience gained by dealing with one may be of great service in operating with the next. It frequently happens that a negative otherwise good may have a very thin foreground or a faulty sky, which may be corrected by shading the thin portion during the exposure. For this purpose a piece of opaque paper or thin board may be used, but it must be kept in motion so as to prevent the appearance of shading lines in the copy. Many negatives too thin to print may be made to yield excellent positives on glass by shading them with ground glass or tissue paper, and giving a scant exposure, followed by slow, careful development.

The copying camera should be pointed toward a clear sky, or toward a part which is evenly covered with clouds. No intervening trees nor buildings should appear on the ground glass of the camera when it is examined with the negative removed from the frame. If any such image can be seen, no matter how indistinctly, it will appear as a dark spot on the finished positive, and as the cause will not be suspected, it may result in the loss of much time and many plates.

For work at night, the negative may be lighted, by one or more lamps with reflectors, but great care is required to secure an even illumination. With the best of the artificial lights which are ordinarily within reach, however, a much longer exposure will be required than for daylight work.

Until quite recently all the best lantern slides were made by the wet-plate process, in fact there were no gelatine dry plates manufactured on which a more than passable lantern slide could be made. At present there are several makers who produce plates on which it is easy to make lantern slides of excellent quality, which are only with difficulty to be distinguished from the best wet-plate work. The latter, however, maintains its position as the standard, on account of its perfect purity in the lights, its trans-

parency in the shadows, and the fineness of the silver deposit composing the image.

The wet-plate process requires perhaps a little more care and experience to attain success, but it is quite simple, being briefly as follows: The first requisite for making any kind of photographic plates is to have the glass perfectly clean. This is accomplished by putting it in any of half a dozen acid or alkaline solutions easily prepared for the purpose, and leaving it there several hours, after which it is removed, scrubbed, and rinsed well in several changes of water. Then follows the abluminizing which consists of flowing over the plate, after the final rinsing, a dilute solution made by shaking up a teaspoonful of white of egg with 8 oz. water and filtering it. The best way is to clean and albuminize a quantity of plates, storing them for use, as they will keep indefinitely. The sensitizing bath is made by dissolving pure nitrate of silver in distilled water, a proper strength being from 35 to 40 grains to the ounce. In the solution is dissolved iodide potassium, one grain to each 8 oz., after which it is acidified by adding nitric acid (c. p.) in the proportion of about 1 minim. of the concentrated acid to 16 ozs. of the bath, which must afterwards be filtered carefully before using. The bath may be kept in a bottle, and poured into a flat glass pan when required for use. To prepare a plate for exposure, dust it carefully, and coat it with collodion by pouring on it a pool near the center, and then by tilting the plate, lowering the corners consecutively, allow the collodion to flow evenly over it, and drain back into the bottle. Any good collodion will answer. I have found that a mixture, equal parts, of Anthony's "New Negative" and "Copying" collodions gives very fine results. After the collodion has set, the plate is placed in the sensitizing bath, where it is allowed to remain until on its being lifted out the solution flows evenly from the surface, without the greasy appearance which it will have if taken out too soon. From two to five minutes is required for sensitizing. The operation is shortened by keeping the bath in motion. As soon as ready the plate is taken out of the bath, drained and placed in the dark slide, after which the exposure should be made as promptly as possiqle.

The usual developer is a solution of protosulphate of iron, made as follows: Sulph. iron 2 oz., acetic acid 2 to 4 oz., water 40 ozs. Care must be taken to cover the plate with a single sweep of the developer, because if it is allowed to flow unevenly streaks

will appear in the film. The image should appear in a couple of seconds, and the development should be complete in from ten to twenty seconds. The plate is then rinsed under the tap, and fixed in a strong solution of hypo-sulphite of soda, after which it is washed for twenty minutes, and then hung on a rack or dried by heat. A better developer is Lea's Sugar Developer, made as follows: In 32 oz. of hot water dissolve 7 oz. of protosulphate of iron, and add 6 oz. white sugar and 2½ oz. acetic acid, which makes the stock. For use take: Stock 7½ oz., acet. acid No. 8. 4 oz., water 18 oz., filter. Add more acetic acid if there is any sign of fogging.

The collodion film is very delicate, and must at no time be touched, or it will be scratched and spoiled. After fixing the plates may be toned in various ways. I prefer a weak solution of chlor. gold, about 1 gr. to 30 oz. water. This is flowed over the plate several times, and requires only a minute or two to act. Bichloride of mercury is often used, and gives a rich purple tone, but I have found that plates thus toned fade considerably in the course of a year or so.

This may seem like a difficult process to those who have been accustomed to the gelatine dry plates, but after the bath has been made and a quantity of plates have been cleaned and abluminized the process is very rapid. I would advise those who try it to provide half a dozen finger stalls of thin rubber, as by using them the silver stains, otherwise inevitable, will be avoided. Excellent dry plates for lantern slides are made by washing and drying collodion bath plates after putting them in a weak solution of acetic acid and flowing over them a strong infusion of coffee. They are developed with pyrogallic acid and nitrate of silver, and give results of the highest quality. They are generally used for printing by contact, as in the camera they are very slow.

I have used but two brands of commercial dry plates success fully for lantern slides—the Anthony Transparency plates and Carbett's Gelatino-albumen. With careful handling these plates give about equally good results, and both almost equal to the best to be obtained by the wet-plate process. Each has, however, its own peculiar advantages and faults. I have thought that the Anthony plates are a little more easily controlled in case of over-exposure, and the Anthony developer is simpler, as it may be made very quickly from saturated solutions of iron and oxalate. The princi-

pal objection to the plates is that the glass varies much in thickness, and is often marred by blebs and scratches, faults due solely to carelessness in its selection.

The glass of the Carbatt plates is about perfect, being thin, clear and uniform. The emulsion requires only about one-half as long an exposure as Anthony's, and when the exposure is just right developes beautifully, but in cases of over-exposure it is not so easily controlled. The best results are always obtained by using the maker's formula for developer, and as this one is somewhat complicated it is not quite so readily prepared, particularly if, as sometimes happens, only one or two slides are wanted.

An excellent plan when a number of lantern slides are to be made is for two men to work together, one to remain in the dark room to develope plates, and the other to make the exposures. By comparing results the proper exposure for the different negatives is readily determined, and in consequence fewer plates are spoiled. The worker outside readily notices changes in the intensity of the light which would escape the attention of one who spent much time in the dark room.

Two men can in this way accomplish far more than if they work independently, and are certain to learn more rapidly, for each will notice some matter of importance that would have escaped the attention of the other. I have found that for this method of working it is well to develope in large trays, about 7x9, and to have at least two developers, strong and weak. Four or more positives may be developed at once, and the work proceeds as rapidly as the exposurers can be made.

Exposures for lantern pictures must be full, in order that detail may be developed in the high lights before the shadows become too dense.

Nothing can be done to save an under-exposed positive, but it must be remembered that only those are under-timed which refuse to develop uniformly when placed in the normal developer.

Generally the most satisfoctory results are attained by trying to expose so that the positive will develop in a solution containing about one-half the normal quantity of iron, and which has also a small quantity of the restraining bromide. If this plan is adopted a plate which refuses to develop properly in the weaker solution is pretty certain to come out when put into the stronger. If plates

are much over-timed it is difficult to manage them, and probably the best plan is to lay them aside and make another exposure. In fact, after one has some experience in making slides, this will be found the best remedy for a faulty plate of any kind. It is so easy to make a good one that it hardly pays to waste time over one which has come to grief.

A much stronger light is permissible for developing lantern slides than for ordinary negative work, as owing to the comparative slowness of the plates, even a tolerably strong orange light is safe. This, of course, adds much to the comfort of the operator, and enables him to proceed more rapidly.

Scrupulous neatness in all photographic work is always well repaid in the results, but in none more so than in the making of these, probably the finest and best of all photographic productions.

NOTE ON A RECENT SYNONYM IN THE PALÆONTOLOGY OF THE CINCINNATI GROUP.

By PROF. JOS. F. JAMES.

(Read June 1, 1886.)

Labechia montifera, Ulrich, vs. STROMATOPORA SUBCYLINDRICA, James.

The first number of "Contributions to American Palæontology," May, 1886, by Mr. E. O. Ulrich, contains descriptions and remarks upon twenty-six species of fossils from the Devonian and Silurian formations of Indiana and Kentucky. These species are distributed among the Bryozoa (sixteen species), Brachiopoda (two species), Gasteropoda (four species), Anthozoa (two species), Hydroida (?) (one species), and Foraminfera (one species). Only one of these species is from the Lower Silurian, Cincinnati Group, and as we are especially interested in this one, a few remarks may be in order.

The species is named *Labechia montifera*, and belongs to that much-disputed class of fossils known as the Stromatoporoids. Whether it belongs to the class under which Mr. Ulrich has placed it (HYDROIDA ?), or to another group is not a question for discussion here. The point to which we wish to call attention is the fact that the so-called new species is an evident synonym for another species described and illustrated in the JOURNAL of this Society in April, 1884, by Mr. U. P. James. It was there named STROMATOPORA SUBCYLINDRICA, and it agrees so well in all its essential characters with Mr. Ulrich's species that one wonders how the error of overlooking it could have been made, as Mr. Ulrich must have been acquainted with the work done here more than two years ago.

In comparing the two descriptions the following points of resemblance are noted. Both are incrusting, in the one case clay, simply, in the other generally "species of *Orthoceras*." Both are cylindrical or compressed; in both the crust is about one tenth of an inch thick; both have undulating surfaces which are covered with scattered conical "elevations" or "monticules," the slopes of which are marked with "lines" or "ridges." The intervening spaces are in both cases covered by "circular or elongate papillæ," or "granular eminences." In both the internal structure is irregularly porous or vesicular, and lastly the horizons at which the two were found were approximately the same, the one being above Morrow, Ohio, and the other Madison, Indiana. Thus there are no differences between the two which would enable any one to separate them, and the *Labechia montifera* falls to the rank of a synonym of STROMATOPORA SUBCYLINDRICA, James.

THE TERTIARY FAUNA OF NEWTON AND WAUTUBBEE, MISS.

By Otto Meyer and T. H. Aldrich.

(Read June 1, 1886.)

The Eocene invertebrate fossils, described and enumerated in the following, were collected in March, 1886, by O. Meyer in Eastern Mississippi, near Newton, Newton County, and near Wautubbee, Clarke County. A great part of the material from Newton, however, was collected afterwards by Dr. E. A. Smith and T. H. Aldrich. The deposit near Wautubbee was first known to the Hon. L. R. Johnson, of the United States Geological Survey. For a description of the geological relations of these strata see American Journal of Science, July, 1886. The type-specimens of the new forms described are in our collections.

Description of New Forms.

In the following descriptions of univalves the term "transverse" is understood to be rectangular to the suture.

Glossophora.

Dentalium incisissimum, n. sp.

Plate II Figure 1.

Smooth, polished, gradually tapering. Section circular. Aperture with a long narrow slit.

Wautubbee.

Cadulus abruptus, n. sp.

Plate II. Figure 2.

Rather large, somewhat depressed. Inflation very near to the larger aperture and suddenly decreasing.

Newton, Wautubbee.

The type specimen is from Newton. Form and position of the inflation distinguish it from the other species of Cadulus of the Southern Tertiary.

Cadulus, sp.

Plate II. Figure 3, *3a*, *3b*.

Two depressed fragments from Newton show an aperture which is different from the other known apertures of Cadulus of

the Southern Eocene. Two distant deep notches on the convex side, and two less distant emarginations on the concave side of the shell divide the margin of the elliptical aperture into four appendages, of which the two small opposite ones are equal, the two larger ones, however, very unequal. It may be that this form represents the aperture of the preceding species, of which we have no example. If, however, the form should prove to be a new species we propose the name *Cadulus Newtonensis* for it.

Fissurella altior, n. sp.

Plate II. Figure 16, 16*a*, 16*b*.

Height two-thirds of the length of the aperture. Fissure on the apex, nearly circular. Surface covered by alternating, radiating and revolving ribs. The crossing points of the larger ribs are mostly nodulous and scaly.

Wautubbee, Newton.

The type specimen is from Wautubbee. *Fissurella Clairbornensis* Lea is lower, has an oblong and less central fissure, a different sculpture and a different inside.

Solarium elegans Lea var. *modestum*, n. var.

Plate II. Figure 6, 6*a*.

Like Solarium elegans Lea from Claiborne, but without ornamentation, the row of tubercles along the suture excepted.

Wautubbee.

Scalaria (Opalia) albitesta, n. sp.

Plate II. Figure 7.

Whorls sessile, rather gradually diminishing in size, covered by lamellar transverse ribs, which are continuous along the whorls.

Newton.

Opalia sessilis Conr. from Claiborne has revolving lines.

Scalaria Newtonensis, n. sp.

Plate II. Figure 8.

Whorls regularly rounded, gradually diminishing in size. They are covered by very fine revolving lines, which on the middle of the whorls are arranged in bands, about five in number.

The very prominent transverse ribs, about nine on each whorl, are lamellar, angularly produced above; their margin is reflected to the right. The fine revolving lines continue on their right side. The left side, however, is sharply defined from the surface of the whorls. The ribs continue over the base, which is defined by an elevated carina. Aperture circular.

Newton.

Eglisia retisculpta, n. sp.

Plate II. Figure 9.

Spire subulate. Whorls regularly rounded. Covered with five elevated, flattened longitudinal lines, crossed by numerous oblique, flattened, transverse ribs, smaller in size. Aperture elliptical.

Wautubbee.

Natica Newtonensis, n. sp.

Plate II. Figure 12.

Shell thick. Depressed globular. Spire low. Suture distinct. Whorls six, convex; body whorl flattened above. Umbilicus deep. Inner lip somewhat spreading over the body whorl.

Newton, Wautubbee, Lisbon, Ala.

The type specimen is from Newton. The form is characterized by its robust, subquadrate shape.

Sigaretus, subg. *Sigatica*, nov. subgen.

Shell globosely auriform. Umbilicus wide. Inner lip without callus. Umbilicus, basal and upper part of the whorls spirally striated.

This subgenus approaches *Natica*.

Sigaretus (*Sigatica*) *Boettgeri*, n. sp.

Plate II. Figure 13.

Spire nearly one third of the shell. Whorls five, flattened above. Suture distinct. Spiral lines near the margin of the umbilicus very strong.

Newton, Miss., Lisbon, Ala.

Sigaretus inconstans, n. sp.

Plate II. Figure 18, 18*a*.

Auriform. Flattened. Covered by elevated, flattened striæ. Three and a half whorls, the last of which is finely striated,

constitute the nucleus, which is situated near the margin. Its plane does not coincide with the general plane of the shell. Umbilicus hidden by callus.

Newton.

There is only one flattened species of Sigaretus known from the Southern Tertiary, *Sig. arctatus Conr.* Its nucleus, however, is not marginal and lies in the plane of the shell.

Cerithiopsis quadristriaris, n. sp.

Plate II. Figure 5.

Subulate. Whorls flat, covered by four smooth, elevated spiral lines, with nearly equal distances. The two in the middle are smaller than those near the sutures. Suture defined by a very small, elevated revolving line.

Newton, Miss., Claiborne, Ala.

The type is from Newton.

Cassidaria planotecta, n. sp.

Plate II. Figure 14.

Spire very much flattened. Three and a half embryonic whorls form a subglobular nucleus. Adult whorls four. Body whorl with two carinas, the upper one carrying subspines. Surface covered with rather distant, elevated, revolving lines. Inner lip spread over the body whorl. Columella irregularly tuberculated.

Newton.

The figure on the plate, though still representing a fragment, is restored from two specimens. The form is characterized by its flat spire.

Columbella mississippiensis, n. sp.

Plate II. Figure 17.

Spire elevated. Whorls nine, slightly convex; the last four with an impressed line along the suture. Base of body whorl spirally striated. Columella excavated, anteriorly with three tubercles. Outer lip thickened, crenulated within by about seven striæ, of which one in the middle is the largest.

Newton.

Fusus Newtonensis, n. sp.

Plate II. Figure 11.

Short fusiform. Aperture and canal more than half the length of the shell. Whorls regularly rounded. More than three

smooth embryonic whorls form the nucleus. They are followed by four adult whorls. These are covered by elevated, revolving lines, which alternate on the whorl body, and which are crossed by elevated lines of growth. The last three whorls besides are ornamented by prominent, obtuse, transverse folds, about ten on each whorl, sigmoidally bent on the body whorl. Aperture angular posteriorly. Outer lip sharp, striated some distance within. Callus spread over the columella. Canal recurved.

Newton.

Fusus subscalarinus Heilpr. has whorls which are flattened on their upper part, while those of *Fus. Newtonensis* are convex.

Murex cancellaroides, n. sp.

Plate II. Figure 15.

Short-fusiform. Aperture and canal less than half of the length of the shell. Embryonic whorls three. Adult whorls five with crowded oblique, rib-like, varices, becoming obsolete on the body whorl. They are covered by numerous, alternating, prominent, elevated, revolving lines. Columella, with an umbilicate fissure. Canal short, straight. Aperture regularly rounded posteriorly. Outer lip thickened, crenate within, the crenation at the middle of the whorl being the strongest.

Newton.

Only the figured specimen has been found.

Marginella constrictoides, n. sp.

Plate II. Figure 10.

Biconical. Spire more than a third the length of the shell. Whorls six, flattened. Columella, with four folds, the uppermost nearly horizontal, the lowest nearly vertical. Aperture straight. Outer lip thickened, crenate.

Newton.

Marginella constricta Conv. from Claiborne is similar; but has the outer lip angular posteriorly, five plaits on the columella, which are besides of different shape and position, has a lower spire and is smaller.

Cylichna volutata, n. sp.

Plate II. Figure 4.

Cylindrical, top regularly conical. Aperture straight, widening anteriorly. Columella anteriorly with a nearly vertical fold.

Newton.

Indistinct revolving impressed lines are only visible under a strong glass. The conical top is distinctly defined from the cylindrical body.

Lamellibranchiata.

Plicatula planata, n. sp.

Plate II. Figure 20.

Covered by small, radiating ribs, consisting of scales and scaly spines. They are larger in rather regular intervals, especially on the sides, and their spines are sometimes rather long. The umbonial part, however, is smooth.

Newton, Wautubbee.

The type specimen is from Newton.

Pecten pulchricosta, n. sp.

Plate II. Figure 23, 23*a*.

Convex, covered by eight broad, rounded, radiating ribs, perceptible in the inside; those in the middle are the largest. Near the ventral margin they dissolve into more numerous ribs.

Wautubbee.

Only the figured valve is known.

Venericardia complexicosta, n. sp.

Plate II. Figure 21, 21*a*.

Rather small. Cordate. Very much inflated. Beak large. Covered by compound, elevated ribs, crenulated near the umbo. They consist of a large median and two small side-ribs. Margin crenulate within, in correspondence with the outer ribs.

Wautubbee.

Venericardia Mooreana Gabb, from Texas, and *Ven. perantiqua* Conr. (*V. subquadrata* Gabb), from New Jersey, have similar ribs, but are less inflated; have a rounded ventral margin and a smaller beak.

Corbula Murchisoni Lea var. *fossata* n. var.

Plate II. Figure 22.

Like *Corbula Murchisoni* Lea, from Claiborne, but the concentric ribs terminate rather abruptly at a depressed line along the carina. Between this line and the carina there are double the number of small concentric ribs. The form, besides, is smaller than in Claiborne.

Newton; Wautubbee; Lisbon, Ala.

The type specimen is from Newton. The sharp and well defined depression along the carina of the umbonial slope is so striking and seems to be so characteristic for the horizon, Newton-Wautubbee-Lisbon, that some might consider it more practical to give to the form a new specific name. This, however, would not show its close relation to *Corb. Murchisoni.*

Neæra (*Cardiomya*) *multiornata*, n. sp.

Plate II. Figure 19.

Posterior half of the surface, with six radiating ribs, the stronger the more posteriorly they are. They alternate with smaller radiating ribs, which do not cover the umbonial part. Anterior half of the surface covered by numerous radiating ribs; its umbonial part is covered by strong concentric ribs, which terminate abruptly at the first radiating rib of the posterior half.

Wautubbee.

Only the figured damaged specimen has been found.

Xylophaga (?) *mississippiensis*, n. sp.

Plate II. Figure 24.

Globular, widely gaping in front. Divided by a radiating line into two parts. The posterior part is convex and covered by indistinct, distant concentric lines. The anterior part is globularly rounded and covered by sharp, elevated, somewhat waving concentric ribs, smaller and crowded on the umbonial part. Its anterior margin is reflected.

Newton.

One single specimen has been found.

LEPADIDÆ.

Scalpellum subquadratum, n. sp.

Plate II. Figure 25.

Carina only known. Its umbo at the apex, pointed. Tectum and parietes flat.

Wautubbee.

Resembles very much *Scalpellum quadratum*, Dixon, sp. (C. Darwin, Fossil Lepadidæ, p. 22, pl. I, fig. 3.), from the English Eocene.

Cephalopoda.

Belemnosis Americana, n. sp.

Plate II. Figure 26, 26*a*.

Phragmocone rather long, straight, with horizontal sutures. Rostrum obtusely conical below, quadrangularly flattened above.

Wautubbee.

Only one specimen of this genus has heretofore been known. It is from the London clay, and seems to be less perfect than our type.

Enumeration of the Species Found.

Glossophora.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Wheelock, Tex.	Jackson.
Dentalium alternatum, Lea	o	o	o	o		o
Dentalium incisissimum, Mr. & Ald		o				
Dentalium minutistriatum, Gabb	o	o		o	o	
Cadulus abruptus, Mr. & Ald	o	o		o		
Cadulus, sp.	o					
Fissurella Claibornensis, Lea	o	o	o			o
Fissurella altior, Mr. & Ald	o	o				
Solarium Meekanum ? Gabb	o				o	
Solarium scrobiculatum, Con	o		o	o	o	
Solarium bellastriatum, Con	o	o				o
Solarium vespertinum ? Gabb	o	o			o	
Solarium ornatum, Lea		o	o	o		o
Solarium, sp.	o	o		o		
Solarium elegans, Lea var., modestum, Mr. & Ald		o				
Solarium nitens, Lea sp		o	o			
Discohelix rotella, Lea		o	o			
Scalaria (Opalia) albitesta, Mr. & Ald	o					
Scalaria Newtonensis, Mr. & Ald	o					
Eglisia retisculpta, Mr. & Ald		o				
Turritella Mortoni C. (=T. carinata, I. Lea)	o	o	o	o		

Glossophora.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Wheelock, Tex.	Jackson.	
Turritella carinata, H. C. Lea........	o		o				
Siliquaria Claibornensis, Lea......	o	o	o				
Trochita trochiformis, Lea.	o	o	o	o		o	
Hipponyx pygmæa, Lea.............	o	o	o			o	
Natica mamma, Lea.................	o	o	o	o			
Natica semilunata, Lea.............	o		o			o	
Natica minor, Lea....	o		o	o	o		
Natica Newtonensis, Mr. & Ald..	o	o		o			
Sigaretus (Sigatica) Boettgeri, Mr. & Ald.................	o			o			
Sigaretus striatus, Lea sp.............	o		o	o			
Sigaretus inconstans, Mr. & Ald.	o						
Eulima notata, Lea sp...............	o		o				
Niss umbilicata, Lea sp..............	o	o	o				
Odostomia elevata, Lea sp..........		o	o				
Odostomia, sp......................	o						
Triforis major, Mr.................		o	o				
Cerithiopsis nassula C. (=C. Langdoni	o		o				
Aldr.)............................		o					Red Bluft.
Cerithiopsis Aldrichi, Mr....	o	o	o			o	Red Bluff.
Cerithiopsis quadristriaris, Mr. & Ald..	o		o				
Cassis, Crevicostata, Con............	o		o				
Cassidaria planotecta, Mr. & Ald.....	o						
[1.] Distortrix septemdentata, Gabb ..	o				o	o	Sowilpa Cr'k, Ala.
Pseudoliva pyruloides, Lea..........	o	o	o	o	o	o	
Phos cancellatus, Lea sp	o		o				Hatchebigbee.
Columbella mississippiensis, Mr. & Ald.	o						
Fusus Meyeri, Aldr........	o						Wood's Bluff.
Fusus raphanoides C. (=Clav. humerosa C.)...................	o	o	o			o	
Fusus altilis, Con.................	o		o			o	
Fusus venustus, Lea................	o	o	o				
Fusus Mortoniopsis, Gabb......	o	o		o	o		
Fusus pagodiformis, Hlpr.....	o			o	o		Wood's Bluff
Fusus Newtonensis, Mr. & Ald	o						
Fasciolaria Moorei, Gabb........	o				o		
Latirus, sp.........................		o					
Caricella reticulata, Aldr....	o	o					Red Bluff
Murex engonatus, Con......... ..	o		o	o		o	
Murex Vanuxemi ? Con	o						
Murex angulatus ? Mr...............	o						
Murex cancellaroides, Mr. & Ald......	o						

Glossophora.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Wheelock, Tex.	Jackson.	
Odontopolys compsorhytis ? Gabb	o	o		o	o		
Voluta Vanuxemi, Lea	o	o	o	o	o		
Mitra fusoides, Lea, var.	o	o					
Mitra pactilis C., var. dumosa C.	o	o		o		o	
Mitra lineata ? Lea	o	o					
Mitra biconica Whitf.	o	o		o			
Marginella ovata, Lea	o		o				
Marginella constrictoides, Mr. & Ald	o						
Ancillaria staminea C. (=Ag. punctuli-	o						
fera, Gabb)	o	o	o	o	o		Wood's Bluff.
Oliva Alabamiensis, Con.		o	o				
Oliva Phillipsii ? Lea	o	o					
Terebra divisura, Con. var.	o	o	o	o	o		
Terebra gracilis, Lea (=T. multiplicata H. C. Lea)	o		o	o			
Conus sauridens, Con.	o		o	o	o	o	
[2] 20 species of Pleurotoma from both localities							
Chiton eocensis, Con.		o	o				
[3] Bulla Aldrichi Langdon (B. biumbilicata, Mr. var.)	o		o				
Cylichna St. Hilairii, Lea, var.	o	o	o	o			
Cylichna volutata, Mr. & Ald.	o						
Volvula minutissima ? Gabb	o						
Actæonin a subvaricata, Conv.	o	o	o				
Lamellibranchiata.							
Ostrea sellæformis, Conv.	o	o	o	o			
Ostrea Johnsoni, Aldr.	o			o			Monroe Co., Ala.
Plicatula Mantelli, Lea.	o	o	o				Enterprise, Miss.
Plicatula planata, Mr. & Ald.	o	o					
Pecten Deshayesi, Lea	o	o	o				
Pecten scintillatus, Con.	o	o		o		o	
Pecten pulchricosta, Mr. & Ald.		o					
Area rhomboidella, Lea	o	o	o	o		o	
Area aspera, Con	o	o				o	
Pectunculus Broderipi, Lea.	o	o	o	o		o	
Limopsis declivis, Con.	o	o	o				
Limopsis ellipsis, Lea sp.	o	o	o				
Limopsis obliquus, Lea sp	o	o	o				
Nucula ovula, Lea	o	o	o	o		o	
Leda multilineata, Con.	o	o		o		o	

GLOSSOPHORA.	Newton.	Wautubbee.	Claiborne.	Lisbon.	Wheelock, Tex.	Jackson.	
Leda sp. (allied to L. improcera C.)...	o						
Leda sp.		o					
Venericardia Sillimani, Lea	o	o	o				
Venericardia rotunda, Lea...........		o	o	o			
Venericardia complexicosta, Mr. & Ald.		o					
Crassatella alta, Con................	o	o	o	o			
Crassatella protexta, Con............		o	o	o		o	
Chama mississippiensis, Con.........	o	o					Red Bluff.
Mysia rotunda, Lea sp	o	o	o	o			
Cytherea minima, Lea................		o	o			o	
Cytherea Hydii ? Lea................	o						
Cytherea Poulsoni ? Con.............	o						
Tellina nitens, Lea sp...............	o	o	o	o			
Mactra parilis, Con..................	o	o	o	o		o	
Corbula Alabamiensis, Lea...........		o	o	o		o	
Corbula engonata, Con......... ...	o	o					Red Bluft.
Corbula Murchisoni, Lea var. fossata, Mr. & Ald......................	o	o		o			
Neæra multiornata, Mr. & Ald........		o					
Teredo simplex, Lea..................		o	o				
Xylophaga ? mississippiensis, Mr. & Ald	o						
DIVERSA.							
Platytrochus Stokesii, Lea............	o	o	o	o		o	
Endopachys Maclurii, Lea............	o		o	o		o	
Flabellum Wailesii, Con..............	o	o		o		o	
Three other species of Corals..........							
Three species of Bryozoa.............							
Scalpellum eocenense, Mr............	o	o	o	o			Entreprise. Monroe Co., Ala.
Scalpellum subquadratum, Mr. & Ald..		o					
Belosepia ungula, Gabb		o		o	o		
Belemnosis Americana, Mr. & Ald....		o					

NOTES.

[1] *Distortrix Jacksonensis*, Mr., though different from *D. septemdentata*, Gabb, is so closely related to this species, that it is probably better to consider it a variety.

[2] The present state of the American Tertiary literature is such that a determination and description of all these species of *Pleurotoma* must be postponed.

[3] *Bulla Aldrichi*, Langdon, is a synonym of *B. biumbilicata* Mr. As, however, the latter name is preoccupied by the similar and perhaps identical *B. biumbilicata*, Desh., Mr. Langdon's name has to be used at present.

THE IDENTIFICATION OF THE BRITISH INCH AS THE UNIT OF MEASURE OF THE MOUND BUILDERS OF THE OHIO VALLEY.

Paper Contributed by J. RALSTON SKINNER, Dec. 1, 1885.

Very fortunate conditions seem to make the identification of the *unit of measure* of the Mound Builders of the Ohio valley both simple and easy of demonstration. One may go further, and say *certain* of demonstration, because certainty rests upon but two matters of fact, which on examination will probably be pronounced established.

The first of these facts is this: That the measures of a great number of these mounds in the river valleys, and on the river terraces of the State of Ohio, as reported by E. G. Squier and E. H. Davis in their great and now somewhat famous work, "Ancient Monuments of the Mississippi Valley," published by the Smithsonian Institution in the year 1848, are to be relied on. It is but fair to say that they are reliable; both from the reiterated statements of these gentlemen and because the Smithsonian Institution gave the work place in its archives. Independently of these considerations the reported measures of these gentlemen contain intrinsic evidence that they were correctly taken, so strong, that we may adopt them as established data for the purposes of our investigation. When this evidence is coupled with (1) the character of the men reporting the measures, (2) the fact that their labors were approved of by and confirmed by Mr. Charles Whittlesey, Topographical Engineer of the State of Ohio, whose surveys of these mounds were made officially, under an act of the State of Ohio, for geological and topographical surveys, and contributed as part of the work of these gentlemen, after they had, as to many, verified and confirmed them, and (3) the acceptance and approval of the institution named, it seems but reasonable to accept it as decisive of the matter. This intrinsic evidence will be quite elaborately given, with a number of quotations as to the character of the surveys, and as to the impressions of the surveyors, taken here and there from their descriptions.

The second of these facts is as follows: The key to this matter is a *stone measure* now in possession of The Cincinnati Society of Natural History. This stone was found in and dug out of

the Sixth and Mound street mound in the City of Cincinnati at the time of its removal, by Mr. C. P. Gridley, now of the City of Springfield, Ohio. He deposited it in the collection of The Western Academy of Natural Sciences, where it was labeled as contributed by him; the original label being now on the stone. The collection of The Western Academy of Natural Sciences, this stone being part of it, passed into the possession of the present society. This is fully verified by the statement of Mr. Gridley himself made to Dr. H. H. Hill, an officer of this society, December 5, 1878, on the occasion of his (Mr. Gridley) coming to this city (Cincinnati) for the purpose of obtaining this stone. The statement is so important that it is made a part of this paper in Appendix A. The elliptical mound in which this stone was found is the same in which was recovered the "*Gest Tablet*" as to which so much has been said and written. (See Appendix C.)

The writer of this paper, while making investigation into the origin of our British measures, was amazed at the ancient universal use of like achitectural symbols all over the world in all lands. Very especially at the almost identity of geometrical display of the Mound Builder's remains with that of the old Egyptian and Hebrews. While examining into this matter in the works of Squier and Davis, spoken of, he was astonished to find that the reported measures given in British feet were such in numbers that a system was disclosed in the general construction, which system could not have been disclosed had any other unit of measure than the British inch been used. So impressed was he with the fact, and yet so impossible did it seem, that in a work, entitled "Source of Measures," published in the year 1875, he made the following remark: "Mounds showing British measures. In searching in the works of Squier and Davis a great number of measures were found, and it was very observable that the English measures seemed so fitting that it was difficult to free the mind from dwelling on their use in the original construction. These measures seemed to be multiples of 3, 4, 6 and 12, and kept running toward the value 360. These facts were noted at the time as curious; but any possible connection seemed, even as it does now, but a wild freak of the imagination, and the matter, though noted, was dropped."

It happened fortunately, that Mr. R. B. Moore, a member of The Cincinnati Society of Natural History, and former President

thereof, became interested in the various discoveries set forth in the works of the writer as to the origin and ancient use of the British measures; as also in the suggestion of their use in the construction of the Mound Builder remains. Having his attention turned that way, it occurred to him to take the measure of the Gridley stone, the outlines of which are here given:

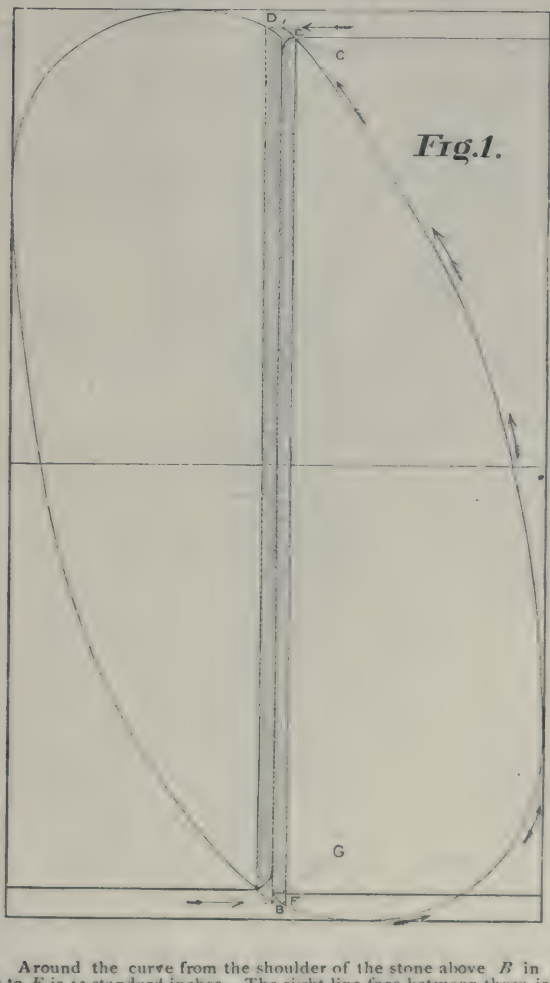


Fig. 1. Around the curve from the shoulder of the stone above *B* in direction of the arrows to *E* is 12 standard inches. The right line face between these is 9 standard inches. The stone is the half of the ellipse and drawn twice, reversing it. The figure is reduced *one-half* size from the exact *fac simile*. The edge of the stone on diameter is beveled, and right line *CF* is 9 inches also. From *E* to *D* to fill the space of the worn point is 11-50 of an inch. The measure of the curve was made December 21, 1882, by use of a strip of firm paper, and referred to a standard rule.

As seen it is the symmetrical half of a nearly perfectly pro portioned ellipse, the straight edge or line being the diameter thereof. On measuring the straight edge, or diameter line, Mr. Moore found it to be precisely nine (9) standard inches, and on measuring the curved edge, or half circumference of the ellipse, he found it to be exactly twelve (12) inches. That is, the measure was that of the folded "*two-foot rule*," but in such form of presentation that the foot, or 12 inches, inseparably connected itself with the measure of 9 inches. The extreme ingenuity of the device certainly does honor to the Mound Builders, for $9 \times 12 = 108$, while $9 + 12 = 21$ five times which is 105, and these two are the typical or key numbers of measures used in the construction of the great and most prominent works in the valley. In addition to this $108 + 105 = 213$, which is a circumference value of a circle whose diameter is 67.8, the *pi* ratio being 35.5 to 113, to be found in the Dunlap works. So also $9 \times 32 = 288$, the number of the measure of that particular circle at Newark, on which Squier and Davis lay especial stress. This combination of measures, as will be seen, is used throughout the Ohio works, whether great or small, of whatever geometrical shape. Mr. Moore made a wooden copy of the stone which he gave the writer, telling him of the measures. But really the statement did not affect him, even to making a trial for the truth of the claim, merely because the fact was so extremely unlikely that it was without consideration rejected. It was not until some two or three years afterward, viz; in the fall of this year, 1882, that the writer's attention was again turned to this matter, from reading in Mr. Wilson's Work, a description of the measures of the Gest Tablet, viz: length 5 inches, greatest width 3 inches, least width 2.6 inches. The fact that both were found in the same mound, and also the fact that Mr. Moore had told the writer that the elliptical stone measured "precisely 9 and 12 inches;" coupled with this statement as to the Gest Tablet, determined him to make the measures of both. He spent the longer part of one afternoon, repeating the trial tests over and over again. A standard measure being used for reference, it was found that Mr. Moore had not exaggerated, but had stated a plain fair fact. The elliptical stone, on its straight edge did measure precisely 9 inches, and around its curved edge precisely 12 inches. The writer requested Mr. Joseph James to make the test also, who took the measures with the like showing. Since then it has been

measured by various parties with the same results. Moreover, it was proved that the stone was approximately the symmetrical half of an ellipse, because by mapping it on paper, and then reversing it on its straight edge, the whole ellipse became produced. As to the "Gest Tablet" see Appendix C.

Even if the contriver of this stone had no idea of the particular unit of measure by which it would as to its straight edge measure 9 (nine) of these particular units, viz: British inches, and its circumference 12 (twelve) thereof, especially when the power and convenience of these numbers for particular architectural purposes is considered, it would seem impossible that he could have chanced on it. The fact that this unit of measure so fits in this exceedingly curious mode of making, showing and preserving a standard of measure is proof of the general intention of the contriver. Couple this fact with another, viz., that the mound in which it was found was an elliptical one "about 440 feet in circumference" a peculiar division of 5280 feet, (for $\frac{5280}{12}=440$) used much in Mound structure. Still further connect with these the further facts which we will show, viz.: that the use ofthis measure in the structure of the Mound Builder works, is confirmed in a great number of instances, nay universally; and that too, by an interchangeable play upon the numbers of the measures, as 12 and 21, 24 and 42, etc. Such being the condition of facts, and such is the condition of facts, one must seemingly come to the conclusion that the British inch and foot were used then just as one would have to now to recognize the measures and scale adopted in the construction of a multitude of rooms, passages, openings, etc., in any large and carefully constructed building of to-day.

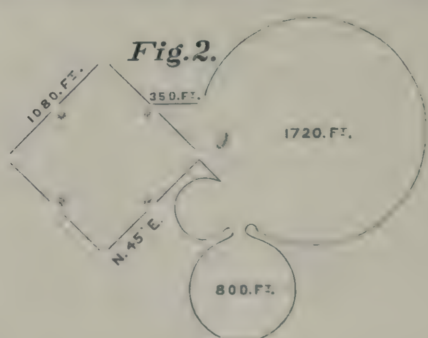
This stone was found and placed in the museum before many of the surveys of Squier and Davis were madeand before any of them were given to the public. They probably never heard of, certainly they have never mentioned the stone. Its appearance is not calculated to draw attention, and so far as we can discover has never been commented on by any one save Mr. Moore. Beyond the facts, that its shape was peculiar, that it was worked, and that it was found in the mound, there was nothing about it to attract more than a passing glance. It was deposited by M. Gridley in the museum at the request of Mr. Carley with some fragments of other pieces of stone found by Mr. Gridley, at the same time and place, and these are now in the collection of the Natural History Society, bearing the original labels.

To enforce what has been said as to the reliability of the reported measures of Messrs. Squier and Davis, a number of statements made by them in their work and bearing upon the matter, are quoted in Appendix B. They are of importance as a part of this paper, but are separated from the text that the actual measures of the works may stand out in clear relief. Premising that this inquiry is confined to what are denominated "The Sacred Enclosures," occupying the levels of the terraces as contra-distinguished from the "Fortifications," or military works, we will now proceed to the classification of the works, agreeably to certain prominent types of of measures used. It will be seen that all the various types of measure are inter-related, the one with the other. While this is of the gist of this paper, it will also serve as a remarkable support to the accuracy and faithfulness of the measures reported.

GROUP I.

This group comprises the use of two circles, a greater and a lesser, in combination with an especial square. This square is identically the same in quite a number of instances, the identity being originally and first discovered, as asserted by Messrs Squier and Davis, upon the compilation of work from the "Field Notes." The measure of the side of this typical square is 1080 feet. As an illustration, the plan of the works in Plate 20, page 56 of Squier and Davis surveys is given (Figure 2.) This work is situated in Ross County, Ohio, eight miles south-east of Chillicothe.

Fig.2.



No. 1. The work just mentioned. As seen the side of the square is 1080 feet One circle has a diameter of 1720 feet, and and the other of 800 feet. An embankment connecting between the square and the circle will be noticed, 350 feet long. 350 feet

is 4200 inches, and one-fourth of this is 1050 inches This relation is significant, because the measure of 1050 feet is the second most conspicuous one in the mound works. So also, 350 is ther everse of 530, and 530 feet as will be seen is part of the side of a square forming the chord of a great circle, in the Hopeton Works.

No. 2. Plate 21, page 57, (we quote from Squier and Davis work,) gives *four* works, similar to No. 1, the square in each being 1080 feet to the side.

(a) A work on Paint Creek, a tributary to the Scioto river, 14 miles from Chillicothe,

(b) A work on "The Crossings of Paint Creek." The great circle is *about* 1687 feet in diameter, and contains an elliptical mound 140 feet long by 160 feet broad, and 30 feet high; also a small circle 250 feet in diameter. The length of the mound is to be noticed, for it is 1680 inches, a multiple of 42, which number divided by 4 is 105.

(c) A work on the Scioto river, 1 mile south of Chillicothe. The great circle of this work has a diameter of about 1625 feet.

(d) A work at Frankfort, or Old Chillicothe, on the left bank of the North Fork of Paint Creek. The great circle of this work is about 1625 feet in diameter.

In addition to the works mentioned, we have as especially setting forth the measure of 1080 feet:—

(1) The great square connected with the cone and ellipse, at Marietta, on the Muskingum river. This square measures 1080 feet to the side. Plate 26 page 73.

(2) The great rectangle at Winchester, Indiana. This rectangle measures upon one side 1080 feet, upon the other 1320 feet, or just one-fourth of a mile. If we add the length of these sides, we have 2400. The number 24 is constantly being used in the works in connection or contrast with 42 its inverse. 4½ times 24 are 108, and 42 divided by 4 is 105. If we subtract 1080 from 1320 we have 240. Plate 33, page 93.

(c) The great rectangle at Hopeton, on the Scioto river, 4 miles above Chillicothe, connected with a great circle. One side of this rectangle is 10800 inches in length. The great circle is in diameter 1050 feet. Here the numbers 1050 and 1080 are brought immediately together.

(4) Two great rectangular enclosed parallels, each 750 feet long by 60 feet wide, or 9000 inches long, by 720 inches wide.

The area of each is 45000 square feet, or together 90000 square feet. This is 10000 times 1296 square inches.

It is noteworthy that the play of the numbers used about these works is the same that is so familiar with us, in our measures of space and time. 1296 square inches is one of our square yards, 4 of which, or 5184, multiplied by 1000 is the number of *thirds* in one solar day of 24 hours, measured on the circle of 360 degrees, as 15 degrees to the hour. That is, a circle of 360 degrees forming 24 hours, reduced to *minutes* and *seconds* and *thirds* gives 5184000‴ as parts It is the measure of time on such a circle that causes the transfer of the measure of right-lined shapes onto circular ones, by a fittingly chosen set of numbers, and the numbers 6, 12 and 36, have always, and with all nations, been used as the numbers for measures in common, for the two kinds of shapes, viz; rectangles and circles. 360×24 is 8640. The half of 864 is 432, and the play upon this number is common among the nations, as 324, 243, etc. 324 is 36×9, as also 108×3, while 1080 divided by 3 is 360. The illustration on Plate 24, page 66, given hereafter, gives this as an area, viz: 90 feet by 360 feet, or 32400, with 240 by 360 which gives 86400. The use is singularly that of the very ancient Babylonians.

GROUP II. A.

This group is characterized by a great circle, whose diameter is 1050 feet. The circle is connected with a rectangle. The illus-

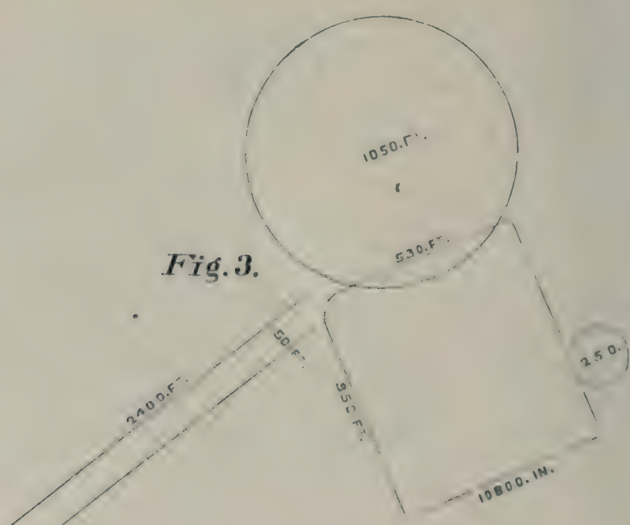


Fig. 3.

tration is the plan of the Hopeton works, Ross Co., Ohio; situated on the east bank of the Scioto river, four miles above Chillicothe, Plate 17, page 51, of Squier and Davis.

No. 1. The Hopeton Works. The great circle is 1050 feet in diameter. One side of the rectangle is 900 feet in length, or 10800 inches. The combination with Group I is at once manifest. The side of the rectangle makes a chord of the circle 530 feet long. 900 less 530 is 370 feet. Five times 370 is 1850 feet, and 1850 less 900 feet, one side of the rectangle gives 950 feet, the other side of the same.

No. 2. The High Bank Works, on the Scioto river, five miles below Chillicothe, Plate 16, p. 50. Diameter of the great circle 1050 feet. This is connected with a great octagon 950 feet in diameter on a measured section.

No. 3. The Seal Township Works, near the Scioto river, in Pike County, Ohio, Plate 24, p. 66. Diameter of the great circle 1050 feet. The great circle is connected by parallels 475 feet long by 100 feet wide, to a square of 800 feet to the side. As to the parallel: 475 feet is 5700 inches, and 100 feet is 1200 inches. The area is 10,000 times 684 inches. 684 is but a play upon 648. Reduced one-half, 684 becomes 342, which number as said is remarkable in its various uses, as 243, 324, 432, and so on They are all multiples of 6, as $72\times6=432$. $54\times6=324$. $40.5\times6=243$ and $57\times6=342$.

GROUP II. B.

Related in measure, this same number 1050 is found in the following works:

No. 1. The Cedar Bank Works, Ross County, Ohio, near the Scioto river, five miles above Chillicothe; Plate 18, p. 52. They consist of a great rectangle, two and opposite sides of which measure, each, 1050 feet. The remaining sides measure 1400 feet each. At the centers of the sides of 1050 feet are entrances 60 feet wide. In the rectangle is a truncated rectangular pyramid, 250 feet long, by 150 feet broad, and 4 feet high, with graded ways leading on to it, 30 feet broad. Near the rectangle is an enclosed rectangular parallel, 870 by 70 feet. Near by is a group consisting of a square of 120 feet to the side, 9 feet high, and a circle 250 feet in diameter, having an entrance 30 feet in width. 250 feet less 30 is 220 feet, the characteristic measure of Group III.

1050 feet is 12,600 inches, the half of which is 6300. The number 63 feet is found on "*The Bird*" in the Newark Mounds and elsewhere. The third of 63 is 21, the inverse of 12, and $21\times5=105$, while $12\times9=108$.

No. 2. The Junction Group, Ross County, Ohio, on Paint Creek, two miles south-west of Chillicothe; Plate 22, page 61. This group, in the connection, is exceedingly noteworthy, as it shows a play upon the numbers 210 and 120, the sources respectively of 1050 and 1080. It consists chiefly of two circles which touch upon the opposite sides of a regular square, contained in a larger square, whose sides are much rounded, almost circular. One circle is 120 feet in diameter, the regular square is 120 feet to the side, surrounded by a bank whose shape partakes of the nature of a square and a circle. The circle upon the opposite side is 210 feet in diameter, or 105×2 feet; hence the unit of measure is 105 feet. Near this last is another circle 210 feet in diameter. Off to one side, at some distance is a regular square of 160 feet to the side, in a very symmetrical figure, 240 feet across, with sides much rounded, and which partakes of the shape of the circle and the square.

No. 3. The remarkable "Graded Way," near Piketon, Pike Co., Ohio; Plate 31, p. 88. The measures of the "way," combine in a special manner, those of Groups I and II. One section of this "way" is 1080 feet long. From this proceeds an embankment 1500 feet long, at the end of which a bank runs off at a slight angle, a length of 420 feet. In the side of the long line, and at right-angles to it a bank projects 212 feet, then an elbow runs parallel with the main line 420 feet, and from the extremity of this last, diverging from it at a slight angle, a bank runs in towards the main line a distance of 240 feet. Here is unmistakable evidence of the purposed combination of the characteristic measures 1050 and 1080 feet, of Groups I and II. 24 feet is 6×4, while 42 feet is 6×7. The fourth part of 4200 is 1050, while $180\times6=1080$ feet. So, also, 212×2.5 530, the chord of the circle in the Hopeton Works, where 1080 is directly connected with 1050.

No. 4. The Portsmouth Works in Kentucky, opposite to the old mouth of the Scioto river; Plate 28, p. 78. This work consists of two ways, or parallels, each 2100 by 210 feet, converging from opposite directions on a square of 800 feet to the side. The unit of measure is evidently 105 feet; or 21 as the inverse of 12.

So 105 feet is 1260 inches, and the number 126 is quite a famous one among the ancients, especially in Hebrew Caballah.

The fact is, these relations of measures so pervade the entire aggregate of the surveys in the work of Squier and Davis, that it would be tiresome, and really unnecessary to repeat almost all their labors simply to force attention by mere accumulation.

Group III.

This group is characterized by the use of the number 110, in combination with 1080 of Group I.

The number 110 is derived from the number 5280, which *in feet*, is one mile in our measure. The divisions of this number give the controlling measures of this group. The number 24 and its inverse 42, gives rise to the numbers as measures, controlling the construction of the works in Groups I and II; and 5280 divided by 24 is 220, and the half of this is 110, which with its multiples make the prominent measures in this group.

The illustration, "Figure 4," is the rectangular ancient work near Winchester, Randolph Co., Indiana; Plate 33, p. 93.

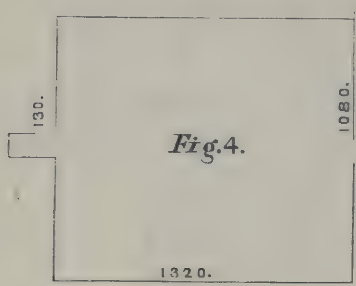


Fig. 4.

No. 1. This rectangle at Winchester. It is 1320 feet in length, on one side, by 1080 feet upon the other. 1320 feet is one-fourth of one mile. 1080 feet as a measure, characterizes the works in Group I. $1320+1080=2400$ feet. In the Newark elliptical work, the number 2400 feet is divided into 1250 and 1150 feet, to make the conjugate diameters. 1320 less 1080 shows the lack to make an exact square. The difference is 240 feet. 1320 is 12 times 110.

No. 2. Rectangle shown in Plate 32, p. 91. It is 220 feet long, by 120 feet broad. $220\times 120=26400$, or 13200×2.

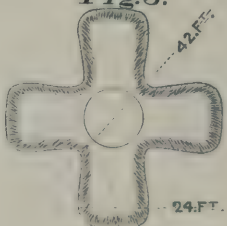
No. 3. Rectangle shown in Plate 29, p. 82. It is 550 feet long, by 630 feet broad. 550 is 10 times 5280 divided by 96. The difference between 630 and 550 is 80 feet, or 960 inches, in the digits of which number we have the divisor of 5280 to give the number 550.

No. 4. Plate 28, p. 78. The work is an oval 110 feet long, by 60 broad (the plans say 70, letter press 60). On the same plate is shown a mound 110 feet in diameter at its base.

No. 5. Plate 23, p. 63. This is a group of 7 circles. Three have a diameter, each, of 130 feet, one of 200 feet, one of 210 feet, and two of 110 feet, each.

No. 6. Plate 36, p. 98. The work is called in the text "The Greek Cross," and is given "Figure 5" because of a remarkable

Fig. 5.



combination of the numbers 42, 24 and 12, and because the foregoing will almost justify the statement that a connection is intended to be shown with the number 1320 feet. The length of the Cross is 90 feet, or 1080 inches. The width of the end of the arm is 24 feet, while the diagonal of the body, is 42 feet, one-fourth of which is 10.5 feet. The circle in the center is 10 feet or 120 inches in diameter. But what is peculiar in this connection is, that if 42 be taken as the diameter of a circle, then the addition of less than $\frac{3}{100}$ of a foot, will give a circumference of 132 feet for the circle, which is the tenth part of one quarter of a mile. Of course speculation is not allowable in a research of this kind, which is simply to tabulate measures given; yet from the lesson of these three groups of measures, it becomes easy to imagine that this number 42, was intended to suggest connected relations of the three groups in one figure. This work is 3 feet, or 36 inches high.

With very few exceptions these three groups of measures are involved in some way, in all the surveyed works of the ancient "Sacred Enclosures," given by Messrs. Squier and Davis. The

groupings themselves, show, by the extraordinary variety, yet perfect dependence, or rather inter-relation, the one upon or with the other, that the surveys *were actual*, and the measures correct as reported. The impression produced by the investigation of the reported measures of these works, is almost irresistable that they are constructions of to-day, made by use of our standard measures, in the familiar denominations thereof. So strong is this impression that unless fortified by proof made positive, it would appear that no reasonable man can believe that the exact measures were correctly reported by Mr. Charles Whittlesey, and by Messrs. Squier and Davis; and this even in the face of the high standing of these gentlemen, and their reiterated averments that their measures were carefully and minutely taken "with compass, line and rule," and were reliable.

I have tried as far as possible to make their own assertion as to their measures good, by intrinsic evidence, and judge that this has been done; for certainly no one could suspect them of purposely making so elaborate and coherent a system of interrelated measures, either when taking the surveys, or as an after-thought, when the "field notes" were brought together. It would have been preposterous for them to have attempted such a thing; nor had they tried, could they, unless by notable perversions, and with very great labor and ingenuity, have fabricated with a different set of measures than used by the Builders, a fraud which would have borne the test of such an analysis as the above.

The discovery of a unit of measure, which exactly fits to the construction of all these works, showing so perfect a system, *as reported*, was the one thing wanting to justify the measures themselves as being rightly taken, and perfectly satisfy the most skeptical. This discovery was made, as already stated, by Mr. R. B. Moore, in the elliptical stone in the treasures of the Natural History Society. It is simply our "*two foot*" rule over again, but connected with another unit of measure, which we do not possess, viz., that of 9 inches. 9×12 inches $=108$ inches, $12\times\frac{7}{8}=10.5$, or $9+12$ divided by 2 equals 10.5 inches, while $12\times 44=528$ inches. The application of these very simple grades of measure explains the base of the construction of all the ancient "Sacred Enclosures" of the Ohio Valley. Dr. Drake reported the measure of the elliptical mound in which the measuring stone was found, as about 440 feet in circumference.

(TO BE CONTINUED.)

PLATE II.

Fig. 1, Dentalium incisissimum, n. sp.
Fig. 2, Cadulus abruptus, n. sp.
Fig. 3, *3a*, *3b*, Cadulus, sp.
Fig. 4, Cylichna volutata, n. sp.
Fig. 5, Cerithiopsis quadristriaris, n. sp.
Fig. 6, *6a*, Solarium elegans, Lea var , modestum, n. var.
Fig. 7, Scalaria (Opalia) albitesta, n. sp.
Fig. 8, Scalaria Newtonensis, n. sp.
Fig. 9, Eglisia retisculpta, n. sp.
Fig. 10, Marginella constrictoides, n. sp.
Fig. 11, Fusus Newtonensis, n. sp.
Fig. 12, Natica Newtonensis, n. sp.
Fig. 13, Sigaretus (Sigatica) Boettgeri, n. subgen, et. n. sp.
Fig. 14, Cassidaria planotecta, n. sp.
Fig. 15, Murex cancellaroides, n. sp.
Fig. 16, *16a*, *16b*, Fissurella altior, n. sp.
Fig. 17, Columbella mississippiensis, n. sp.
Fig. 18, *18a*, Sigaretus inconstans, n. sp.
Fig. 19, Neæra (Cardiomya) multiornata, n. sp.
Fig. 20, Plicatula planata, n. sp.
Fig. 21, *21a*, Venericardia complexicosta, n. sp.
Fig. 22, Corbula Murchisoni, Lea var., fossata, n. var.
Fig. 23, *23a*, Tecten pulchricosta, n. sp.
Fig. 24, Xylophaga ? mississippiensis, n. sp.
Fig. 25, Scalpellum subquadratum, n. sp.
Fig. 26, *26a*, Belemnosis Americana, n. sp.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THE JOURNAL

OF THE

Cincinnati Society of Natural History.

VOL. IX. CINCINNATI, OCTOBER 1886. No. 3.

PROCEEDINGS CINCINNATI SOCIETY OF NATURAL HISTORY.

June 16, 1886.

Special meeting under the direction of the Lecture Committee to hear papers on the Destruction of Native Birds.

Vice-President Skinner occupied the chair. Papers were read by Messrs. Chas. Dury and Wm. Hubbell Fisher, and Prof. Jos. F. James replying to Dr. Langdon's remarks at the regular meeting of June 1st.; Dr. Langdon followed with remarks and Messrs. Dury and Fisher responded.

After a prolonged discussion the meeting adjourned at about 11 p. m.

BUSINESS MEETING, *Tuesday, July* 6, 1886.

President Dun in the Chair. Sixteen members present.

The reading of the minutes of Executive Board was dispensed with.

H. F. Farny and Prof. T. H. Norton were proposed for active membership. Prof. R. W. McFarlane, of Oxford, Ohio, was recommended for honorary membership by the Executive Board.

Messrs. H. P. Piper and H. M. Brown were elected active members.

The Committee on the Destruction of Native Birds submitted the following report:

To the Cincinnati Society of Natural History:

Your Committee report that they have carefully investigated the subject of the *Destruction of our Native Birds*. Several papers

have been prepared and read at three meetings of this society. They find

First—That native birds of many species have greatly decreased in numbers over large areas of the country. This is particularly true of those water and game birds about which it is comparatively easy to obtain statistics.

Second—That the chief causes of such decrease, in addition to climatic changes, natural enemies, clearing up the country, etc. are

1—The destruction of birds for their skins and feathers, for decoration and millinery uses.

2—The trapping of birds for cages.

3—The destruction of eggs and nests by men and boys.

4—The introduction of the European sparrow (Passer domesticus), which occupies the nesting places of many native species.

Three of the destructive causes are preventable and the evils resulting therefrom can be greatly lessened:

First—If no birds be used for decoration.

Second—If none of the song birds and insectivorous species be used for food.

Third—If the laws protecting certain species be backed by stronger public opinion and more rigidly enforced.

Fourth—If thoughtless men and boys could be shown the great economic value of birds and taught to protect them and their eggs.

Your Committee think a wide spread discussion of this bird question shows more interest in "Our Feathered Friends" than was hoped for, and they trust that Cuvier Clubs, Audubon Societies and and other clubs of like aims, will continue to flourish on all sides until public sentiment and practice is entirely opposed to the Destruction of our Native Birds.

Respectfully submitted,

R. H. WARDER,
CHARLES DURY,
WM. HUBBELL FISHER.

CINCINNATI, O.,
July 6, 1886.

It was moved that the report be received and the Committee continued.

Dr. F. W. Langdon said:

Mr. President—It is fully understood, I trust, that in the discussion on birds, which has occupied your attention for several meetings past, only the kindliest personal feelings exist between my ornithological friends and myself. Any criticisms of your Committee by myself are to be taken, of course, in strictly an official, not a personal, sense.

The discussion has been conducted purely in the interests of the Cincinnati Society of Natural History, with a view to awakening public interest in the subject and in the society. That it has been a success in these respects, I think you are all aware. I beg leave to object to the adoption of the final report of your Committee as read to-night, on the following grounds:

First—That it entirely evades the main question at issue, viz., "the destruction of North American *song* birds for millinery purposes."

Secondly—It inferentially supports the proposition that "song birds" are habitually and commonly used for food, when such is the case in only limited localities.

Thirdly—It inferentially expresses the opinion that sportmen's clubs and "Audubon Societies" are "*entirely*" opposed to the destruction of native birds, which is notoriously not the case.

Fourthly—It aims at the impracticable when it seeks to create a "public sentiment *entirely* opposed to the destruction of our native birds." This would be a death blow to the progress of ornithological science; would conflict with the interests of all sportsmen and sportsmen's clubs; draws no distinction between desirable and undesirable birds, and would be as irrational as to *entirely* oppose the destruction of mammals, reptiles, fishes or plants.

Fifthly—While the report of your Committee states as a self-evident fact that water and game birds have markedly decreased over wide areas, it ignores the undoubted increase over those same areas of the smaller and more useful species to man, viz.: song birds and insectivorous species generally.

Sixthly—The report of your Committee, viewing the subject from one side only, arraigns man for his *destruction* of birds, while it fails entirely to give him any credit for his *constructive* influence, which has been repeatedly emphasized in the course of the discussion.

Finally—I would caution the society, as a scientific body, against hastily committing itself to a one-sided view of an important question, on insufficient evidence and with but a handful of members present; and it would urge those members present to think twice before putting the society on record as a body swayed by sympathy and prejudice rather than by facts, reason and judgment.

Mr. R. H. Warder said that Dr. Langdon, in his papers, confined his remarks to song birds, whereas the report of the Committee referred to *all* native birds. The original resolution should have read "Our *Native* Birds," not "*Song* Birds."

Dr. Langdon said he did not confine his remarks to song birds. He thought man's protective as well as his destructive powers should be recognized.

Mr. Fisher remarked that Dr. Langdon's statement that the whole movement is a shrewd advertising scheme of an enterprising Eastern journal, is not just, any more than a charge that the New York World's advocacy of the Fresh Air Fund is an advertisement for that paper. The Audubon Society, a branch of the American Ornithologists Union, is disinterested in its work. All means possible should be and are being used to bind up a public sentiment against the destruction of birds. The object of the Committee has been to encourage such a sentiment, and to enforce the laws protecting birds.

Mrs. Jos. F. James thought that Dr. Langdon's papers had been an injury to the cause. Persons had refused to sign the pledges, quoting Dr. Langdon as authority for the belief that birds are in no danger of extermination.

Dr. Langdon said in reply that his papers had stirred up an interest in the subject, and if members were joining the Audubon Society at the rate of 1000 per day, as he had heard, he thought no harm had been done.

Mr. Warder, on behalf of the Committee, desired to make the report final.

Mrs. James moved its adoption, seconded.

Dr. Langdon objected.

The motion was carried.

Prof. Jos. F. James read a paper, by title, on the Geology and Topography of Cincinnati, being the conclusion of a paper read at the previous meeting.

The Society, by a special vote, requested the paper to be read in full at the meeting in August.

Messrs. Dury and Langdon requested that facts and short articles for a Zoological Miscellany for the Journal be sent in.

Donations were announced as follows, and the Society adjourned.

From Bureau of Education, Circular of Information, No. 5, 1885; from Forum Publishing Co., "The Forum," vol. 1, No. 1; from Publishers, "American Sportsman," June 19, 1886; from Chief Signal Officer, Monthly Weather Review for April; from Director of Geol. Survey of India, Records of Geol. Survey of India, vol. 19, Part 2; from Jos. F. James, the "Weather Journal," Nos. 1, 3, 4, 5, 6; from Carlos Shepard, Bone and Pottery from mouth of East Fork, L. M. R., Flints from same, Spear Point from Clermont Co., O.; from Dr. O. D. Norton, Seeds of Sorghum vulgare, Oriza sativa, Melia Azederach; from Wm. H. Knight, Flammarion's "Wonders of the Heavens"; from U. S. Fish Commissioner, Bulletin of U. S. F. C., vol. 6, Nos. 4 to 8; H. H. G. Smith, specimen of Cecropia Moth; from F. W. Langdon, M. D. specimen of Trox sp.; from Mrs. Wm. Andrews, Twelve Volumes of Books; from U. S. Geol. Survey, Monographs, vol. 9; from Geo. S. Huntington, Star Fish and Echinoderms from Florida, one Trunk Fish.

Adjourned.

SCIENTIFIC MEETING, *Tuesday*, *August* 3, 1886.

President Dun in the chair. Twenty members present.

Prof. Jos. F. James read his paper on the "Topography of Cincinnati," presented by title at the July meeting.

Mr. Wm. H, Knight read a paper on "Photographing the Stars; recent discoveries in the Plieades."

Dr. Dun calling Prof. James to the platform presented, with appropriate remarks, an engrossed copy of the following "Testimonial":

"This Testimonial is presented to Prof. Jos. F. James by the Cincinnati Society of Natural History, on his resignation of the position of Custodian, which office he has efficiently and faithfully occupied from 1881 to 1886—always conscientiously attending to his multiform duties, furthering the interests of the society and gaining the good-will of the members by his agreeable demeanor and his uniform willingness to oblige. He takes with him to his new sphere of usefulness as Professor of Botany and Geology at the Miami

University the esteem and best wishes of the members and officers.

(Signed by the officers of the Society and members of the Executive Board.)

Prof. James responded thanking the Society for the token of esteem and bespoke for his successor the same kindness and sympathy in his work that had been accorded to him.

Prof. Mickleborough, of Brooklyn, N.Y., who was present, by request, addressed the Society, congratulating it upon the work accomplished during the past two or three years.

Mr. Wm. Hubbell Fisher presented the following resolution:

"Resolved: that the Cincinnati Society of Natural History fully and heartily endorse the statements and sentiments of the President's address and those of the "memorial" presented to Prof. Jos. F. James."

Upon motion, duly seconded, the resolution was unanimously adopted.

Miss Lizzie Laws, Miss Annie Laws and Mr. A. C. Siewers were proposed for members, and Messrs. H. F. Farny and T. H. Norton elected to active membership.

Prof. Jos. F. James offered his resignation as Librarian.

The resignation was accepted and the election of a successor ordered for the next meeting.

Dr. Dun then presented to the Society the newly elected Custodian, Mr. Horace P. Smith.

Donations were announced as follows: From Mrs. Mary Stubbs, seeds and pods of Sweet Gum; from R. H. Warder, Volume of Essays and Addresses by John H. Warder; from Prof. Geo. W. Harper, steel plate Portrait; from R. O. Collis, Trays of animal bones from Madisonville; from A. E. Heighway, M. D., specimen of Canada Porcupine; from T. J. McAvoy, specimens of Snake, Frogs, and Bat, specimen of Tetradium fibratum; from G. H. Curtis, one slide of Diatoms; from Zoological Garden, skin and skull of Oppossum; from T. P. Gore, Specimen showing union of saplings; from Chief Signal Officer, U. S. A., "Monthly Weather Review"; from Mrs. R. W. Summers, Herbarium specimens; from Geo. C. James, specimens of Lignum vitæ; from Dr. O. D. Norton, skin of Rocky Mountain Lion, specimen of Tin Ore; from Alex. Starbuck, eighty specimens of Bird Skins.

TUESDAY EVENING, *Sept.* 6, 1886.

SCIENTIFIC MEETING.

President Dun presiding. Sixteen members present.

Dr. Langdon presented remarks upon the Birds of the Chilhowee range of the Great Smoky Mountains of Tennessee.

Prof. Jos. F. James read, by title, a paper of the "Sponges of the Cincinnati Group."

Prof. James also read an extract from a letter from Prof. J. S. Newberry, saying that he had matter in hand regarding New Fishes from the Devonian Rocks of Ohio, and asking if the Society would be willing to publish it.

Dr. Newberry was, by motion, seconded and carried, invited to read a paper on the Devonian Fishes of Ohio.

Dr. Heighway spoke upon the late meeting of the American Association for the Advancement of Science at Buffalo.

Members were elected as follows: Misses Lizzie and Annie Laws, and Mr. A. C. Seiwers, and the following persons proposed for active membership: Dr. John D. Jones, Mr. Horace P. Smith, Mr. Theo. P. Anderson, Jr., Miss Emily Hopkins, Miss Mollie Gohegan.

Prof. Geo. W. Harper was elected Librarian to succeed Prof. James, resigned.

The Curator of Botany, Miss Nettie Fillmore, announced that the section of Botany would resume its weekly meetings, beginning September 11th, at 2 p. m.

The President called the attention of members to a set of the Publications of the Geological Survey of India lately received in exchange.

Adjourned.

Donations were received during the month as follows: From Dr. W. A. Dun, indian relics, bird skulls, ears of rabbit, specimen of Agate; from Mr. Bryant, crystal of Beryl, shells of Anodonta dicora; from Dr. O. D. Norton, specimens of Syenite, "Histoire Naturelle des Oiseaux ornee," Albin 1750; from Dr. W. A. Dun, lantern slides, fragments of ancient pottery, arrow points, specimens of Lava, Pyrites, bronze medal, mosaic from Venice, specimen of silver ore; from Miss Magurk, impressions of coal plants, herbarium specimens from Lookout Mt.; from Jos. F. James, pamphlets; from Al. Gahr, specimen of iron ore, fragments of pottery, flints; from Baron Felix von Thumen, Monograph, "Der Reben Mehl-thau."

THE GEOLOGY AND TOPOGRAPHY OF CINCINNATI.

By Prof. Jos. F. James,

Custodian of Cincinnati Society Natural History.

Part II.

TOPOGRAPHY.

(Read August 3rd, 1886.)

Turning from the Geology to the Topography of the City, we find many interesting features developed. The so-called hills, which rise to the north, are of heights varying from three hundred and ninety-six feet above low water, the stated height of Mt. Adams, equal to eight hundred and twenty-eight feet above the sea, to four hundred and sixty feet given for Mt. Auburn, or eight hundred and ninety-one feet above the sea.

It is almost impossible to conceive a correct idea of the appearance of the site of Cincinnati before it became a city. The pictures we have, which pretend to show its appearance in 1802, or fourteen years after its first settlement, represent the two terraces to be nearly bare of trees, a few clumps appearing here and there only, but the hills and valleys to the north are represented as densely clothed with forest trees. They recede from the river to the westward, and in one view six elevations are shown with depressions between them. These hills, as we may for convenience call them, were originally rounded on top, and with sloping sides, but are now so cut away and seared with streets as to have lost much of their original form.

There still remain, however, the great drainage valleys which have, for ages, carried the water from the north, south into the Ohio river. None of them, except Mill Creek, which, as shown in the first part of this paper, now occupies part of the ancient channel of the Ohio, are of any great extent, and this is one fact tending to prove the former insular character of the suburban parts of Cincinnati. The most eastern one of these valleys emptying into the Ohio is Crawfish Creek. This divides Mt. Lookout from Walnut Hills, forming a broad plain at its mouth, always overflowed by high water in the Ohio, and it heads up several miles in the country, now covered by part of East Walnut Hills.

The next valley to the west is Deer Creek, and this separates Mt. Adams from Mt. Auburn, and is of less extent than the first one. For the extreme northern end of this valley is south of Oak Street, Mt. Auburn, less than two miles from the river, and it here meets a ridge which divides it from a valley draining to the northward.

The third of these valleys is that between Mt. Auburn and Clifton Heights, and is even shorter than the second one, finding its head, also, at the ridge before spoken of.

Still further west is a yet shorter but steep valley, and then there are no others until the broad valley of Mill Creek is reached, and this is bounded on the other side by the long range of which Mt. Harrison is a part.

While all these valleys and their attendant heights have added greatly to the picturesqueness of the city, they have, at the same time, been taken advantage of in the building up of the suburbs. The heights have been utilized for dwellings, while the valleys between have proved invaluable for streets. Mt. Tusculum, Mt. Lookout, Mt. Adams, are all dotted with residences. Walnut Hills has become a city in itself, in many places as compactly and solidly built up as the business centre; while Crawfish and Deer Creeks have been found of the greatest service in giving access to the country on either side, and to the northward. Mt. Auburn and Clifton Heights each occupy a peculiar position on a long, narrow tongue of land projecting southward and ending in abrupt precipitous banks, to ascend which steam has been evoked. Both ridges are so narrow as to admit of but one street and a row of houses on each side. Back of the houses the ground slopes rapidly down into the ravines, and this narrow space has been the cause of the stationary condition of these two suburbs, while Walnut Hills has gone on so rapidly expanding.

The two tongues of land are similar in another respect, for while they both jut southward and end abruptly, their northern ends abut against an east and west ridge which forms a connecting link between the most western limit on Mill Creek and East Walnut Hills. This ridge forms indeed the water shed, the divide between the drainage directly into the Ohio river, to the southward. and the round about passage into Mill Creek, to the northward. The village of Avondale lies on the north side of this ridge, and thus can by no possibility drain its sewage into the Ohio river except through the medium of Mill Creek or Duck Creek.

While the ridges have, as shown, been utilized for the purposes of residences, the valleys have been equally serviceable for streets and roads. Crawfish Creek, for example, is used not only by a wagon road, but by the Mt. Lookout Dummy Railroad. Deer Creek valley serves for the Northern Narrow Gauge, Hunt street and Gilbert Avenue. The ravine between Mt. Auburn and Clifton Heights serves Vine Street an excellent purpose, in climbing to the top, by a long, gradual slope. The ravine next west is used by Clifton Avenue, while the great Mill Creek valley is of incalculable advantage to numerous railroads and the Miami Canal, enabling these to reach the heart of the city with no grades of any consequence whatever.

The tracing of the divide, which separates the Ohio river drainage from that of Mill Creek, is an interesting matter. Investigation shows it pursues a general north-east and south-west direction, and for part of its course can still, with all the changes attendant upon the building of a large city, be followed in quite a definite manner. Beginning at the extreme southwest end, at a point overlooking Mill Creek, we find it follows a line to the north-east, and touches the western end of Calhoun street in Clifton Heights. It then turns east and follows a little to the south of Calhoun, across to Mt. Auburn, and forms the ridge which has already been referred to, as the north end of the spurs, occupied by Ohio and Auburn Avenues. Just where Calhoun street and Ohio Avenue come together there is a deep ravine, trending to the south, through which the water is carried to the Ohio river, and up the lower part of which Vine street has been built. On the north side of Calhoun is another deep ravine, which trends northward, finally forming part of Burnet Woods Park, and carrying other water into Mill Creek somewhere near Ross Lake. Calhoun street is, in most places, just wide enough for the road-way and houses on each side, and back of the houses the ground slopes rapidly north and south. Following the divide, as it is now plainly seen to be, to the eastward, we find that the Mt. Auburn water tanks, on Auburn Avenue, stand upon it, that Auburn street follows its winding course, and is of the same character as Calhoun street, namely, just wide enough for the road way and houses on each side. When Highland Avenue is reached the divide trends northeast again, and upon its highest point is situated the house of John Shillito. Thence it follows Oak street to the Reading road,

crossing this, and taking a southeast course toward Crown street, and then diagonally southeast to Macmillan. Along Macmillan to Gilbert Avenue seems next its course, and then from the junction of these two streets it goes diagonally to the bluff, south of Macmillan street, and immediately over-hanging the river. Here it ends abruptly, and all the drainage of East Walnut Hills is carried east and north into ravines running into Crawfish and Duck Creeks, and far north into Mill Creek.

The peculiar features of ravines, heading up on both the south and the north sides of the divide, reminds one of the remarks of Capt. Dutton, quoted in part one of this paper, that in mountainous countries the ravines form a series of amphitheatres close to a narrow divide which remains sharp in all stages of erosion. We find this to be exactly the state of affairs on Calhoun and Auburn streets, for there, on both north and south sides, the heads of ravines come up close to the narrow knife-like water shed.

While the Mt. Auburn and Ohio Avenue ridges project to the southward of the divide, there are others of a similar character on the north. One of these runs in a long, beautifully gentle slope through the western side of Burnet Woods Park, and the other is utilized by upper Vine street and Ludlow Avenue. The two latter form the main streets of Corryville, and if the former ridge were not a portion of Burnet Woods, there is no reason why it should not have built upon it a new suburb equal, if not superior, in beauty, to Clifton Heights and Mt. Auburn.

Walnut Hills, on the contrary, occupies no such pronounced tongue of land, but covers, with its fine residences, a vast undulating tract, the most level of all that remains of the plateau which once existed. Avondale, too, occupies a similar rolling tract of country, and is also situated on the northern slope of the divide, so that all its drainage flows into Mill Creek to the northward, though eventually into the Ohio.

On the east side of Avondale, beginning about half a mile from Macneale Avenue, is one of the most beautiful valleys in the neighborhood of the city. At its upper or southern end it is rather narrow, and through its centre wanders a small brook. As we go down the valley widens and deepens. The little brook becomes larger and cuts deep into the rich soil, and the green hill-sides rise on either hand with few or no trees. Toward the lower end trees become more abundant, but in no case do they form a thick

growth, and there is no appearance of their ever having done so. In one place where a lateral ravine comes into this wide one are several granitic boulders, evident waifs from some far away source, probably deposited by an ancient glacier which had here stopped and melted.

On the northwest side of Avondale is another deep ravine still covered with the original forest, and deep down in its shady recesses meanders a little brook which carries away the surplus water to its final resting place, Mill Creek. This ravine, unlike the first one, is still clothed with the primeval forest, and huge giants some of the trees are. This is a favorite picnicing place, and here too, children and their elders go in spring to gather wild flowers. The Carthage Pike crosses this ravine near its lower end, where it has lost all its forest beauty from having been used for so many years as part of a dairy farm.

The Rev. G. F. Wright, of Oberlin College, Ohio, after making an exhaustive study of the glaciated surface in Pennsylvania, Ohio and Indiana, found that the southern foot of the continental glacier crossed the Ohio river somewhere near Point Pleasant, about twenty-five miles above the city, and extended a short distance into Kentucky, recrossing the Ohio at Aurora, Indiana, and thus blocked the course of the stream for about fifty miles.*

In commenting upon this circumstance another writer, Prof. I. C. White, estimates the height of this glacial dam at 645 feet above low water in the Ohio river at Cincinnati.† Now the highest land at present about our city is 460 feet above low water mark. I have examined many places on the tops of the hills in this city, and on none of them have I seen any traces of glacial drift. The bedded rocks are close to the surface, and only have on top of them such soil as would have been naturally formed by the disintegration of the rocks themselves. That there is glacial drift near the bases of the hills and in the valleys can not be denied, for the evidence is everywhere abundant, but that it ever existed on top of the highest ground about this city, I do not think can be proved. It therefore remains a question whether the icy barrier could have reached any such height as six hundred and forty-five feet above low water, and thus covered the highest ground with a mass of debris of which no trace remains.

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*Abstract in Pro. Am. Asso. Adv. Sci., vol. XXXII., p. 207.—See also Ohio Geol. Vol. V., p. 750, *et seq.*

†Ibid, p. 213.

From all the facts given in this paper, it is easy to see the interesting features of our city's surroundings. The broad, deep stream of the Ohio, which, passing our city in a graceful curve, gives life to many thousand square miles of country, the two gravel terraces, the wonderfully carved plateau, with its diversified aspect of valley and ridge, its deep ravines and its gentle slopes, together with its vast store of fossil remains, famous the world over, these are its attractions. Nor is this all, for, situated on part of the oldest dry land in the Western World, its site can boast an antiquity which puts to shame many more renowned cities. And while New Orleans has been founded upon a soil which is yet saturated with its baptismal shower, Cincinnati has planted herself on rocks hoary with the age of countless centuries; rocks which form the everlasting hills; rocks which were gray with moss when the site of Louisville was fathoms deep beneath the ocean waves; when that of St. Louis was as yet scarcely even in the process of formation; long before even the grandeur of the Rocky Mountains was revealed to the wondering vault of heaven, or the Mississippi babbled a tiny brooklet among the Archean Mountains of the far north. Thus we can boast an antiquity far greater than many other American cities. And, though the settlement made by man has not yet attained to its hundred years, its foundations date far back into the earliest history of the earth; to a time, compared with which the epoch of man himself, upon our rolling globe, is but the fragment of a minute in the long roll of countless centuries.

THE IDENTIFICATION OF THE BRITISH INCH AS THE UNIT OF MEASURE OF THE MOUND BUILDERS OF THE OHIO VALLEY.

Paper contributed by J. Ralston Skinner, Dec. 1, 1886.

(Continued from page 127.)

Group IV.

Can we not admit, then, as established, that the Mound Builders possessed a standard unit of measure, which is to-day known and used as our British inch? If so, they possessed a standard of 12 of these inches, combined on the same tablet with one of 9 inches, the tablet being of such a form that the 12 implied the use of 24 inches. This arises from the natural suggestion of completing the ellipse by doubling the curvature of the elliptical measuring stone or tablet. In making use of their tablet we find that they applied the same numbers interchangeably as designative of sides of squares, of rectangles, of lengths of long parallel ways, and as connected with circles (and ellipses), both to measure diameter and circumference lines. Indeed, the relation of square to circle, in terms, for measure of the general constructive numbers, or simpler, in terms of the number 6 and its multiples, is everywhere beyond contradiction manifest.

From this it becomes safe to say that this mode of construction rested upon a knowledge of the relation of a right line to the curved one of the circle, or of diameter to circumference of the circle; and consequently of the relations of circular and rectangular areas. The Mound Builders knew of the geometrical relations of these shapes, of their numerical ratios, and had the peculiar standard of measure mentioned to exhibit the numerical relations by application to the shapes themselves. We will try and show this from the works.

The exception is so rare to the use of the multiple of 6 feet, or to the numbers 210, 120, 420, 240, 1,080, 1,050, and the divisions of 5,280, that when found it is worthy of especial attention. Such an exception does take place as to the measures of one great and distinctive work, and one of the groups of works of the Scioto Valley, near Chillicothe. But while it is such an exception, nevertheless we do find its remarkable measures connected with *the combination* of the most prominent measures of the groups, viz., 1,080

and 1,050, so as to show the numerical relation of diameter to circumference of a circle. We will show this, but will first set forth one work, which directly and significantly shows the knowledge of the circle of 360, connected with the measure of 240 and 90 feet, or 1,080 inches. This work is part of the Seal Township Group, in Pike County, Ohio, near the Scioto river, Plate 24, p. 66. In this group are some of the most perfect figures of the circle inclosing a square, the diameter of the circle being 300 feet, and the side of the interior square 125 feet, and of the ellipse. As to the circle and square the Authors say: "Nothing can surpass its symmetry," and further: "It will be remarked that we have here, the square, the circle and the ellipse, separate and in combination,—all of them constructed with geometric accuracy." As to the work to be shown, "Figure VI," they say: "its outlines beautifully distinct;" and they conclude: "It is impossible to resist the conviction that some significance attaches to these singular forms."

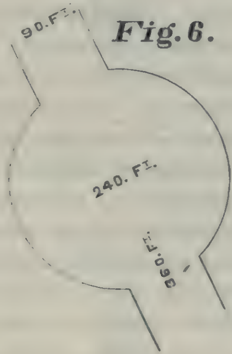


Fig. 6.

Here, in Figure VI, we have the circle of 240 feet in diameter. $240 \times {}^{8}\tfrac{7}{2}{}^{5} = 1050$. The width of the passage way through the circle is 90 feet, or 1080 inches, 1080 divided by 3 is 360, and the length of the passage way is 360 feet. This is 4320 inches. The length of each arm of the passage-way is 60 feet, or 360 inches, multiplied by 2, 360 less 120 is 240 feet, the diameter of the circle, or 2880 inches, the circumference, in feet, of the famous Newark circle, which will be given in its place. 4320 less 2880 is 1440, 144 being the square of 12. $432 \times .75 = 324$, twice which is 648. These two numbers viz.:- 432 and 324, were especially used with

the Chaldeans and ancient Babylonians, or pre-Semites With the Chaldeans, from the beginning to the deluge, was 120 *sari* of 360 years each, or 43,200 years. In the very most ancient Babylonian account of the flood, taken by George Smith, from the cuneiform tablets of Nineveh, the use of this number with 1080 and 360 is made so as to bring out a play upon these numbers, 432 and 324. Khasisatra is relating to Ishdâbar (Semitic compound word, meaning "*Man-Word*") the events of the deluge. He says, in regard to constructing the Ark, and furnishing it: "I poured on to the exterior 3 times 3600 (10800) measures of asphalt, and 3 times 3600 (10800) measures of asphalt within. 3 times 3600 (10800) men, porters, brought on their heads the chests of provision. I kept 3600 chests for the nourishment of my family, and the mariners divided among themselves 2 times 3600 (7200) chests," that is, each porter had 2 chests. Here 10800 is used 3 times, making 32400, or our number 324. Add 3600 mentioned once and we have 36000, to which, if we add the remaining 7200, we have 43200, wherein, by the combination, we obtain the other of our numbers 432. The intention to show the relation is obvious. These are the familiar numbers, with a like play upon them, in the Mound Builder works, but with the relation established as an interchangeable play upon geometric shapes and linear measures. The Chaldean account uses the numbers with relation to time and capacity measures, and men. The probably most important use of this number 432, with 234, was astronomical. Together 432 and 234 make 666. We see that $10800 \times 3 = 32400$ is a manifest play upon the number 432, and 32400 is the half of 64800. Let 64800 feet be the circumference of a circle, that is practically the circumference of the great Newark Circle, 2880×22.5. The diameter of this circle will be 20626.4700 + feet. But as *seconds* in *time* measure 206264.700 *seconds*, is the *radius* seconds of a circle whose circumference is 360 degrees, and this particular radius is made use of in the common astronomical formula of to-day for finding the sun's distance. So, also, the ancient Egyptian Cubit, "Nilometer," has been measured as 20.625 British *inches* (Wilkinson). Use it as 20.62647 B. inches, a difference of .00147 of an inch in 20 + inches, and the details of construction of the Great Egyptian Pyramid can be recovered, in the *actual measures* (British) made of those details by the most careful experts. Now 20625 is of itself a most important number, and shows itself in the constructive frame-work of the *denominations*

of the British measures which were used by the Mound Builders, as we see, and by the ancient Egyptians. So that in these mound constructions, we not only have the peculiar play of numbers common to the old Chaldeans and Egyptians, but also the same numbers applicable with the same identical unit of measure, viz.: the British inch. Let us explain this. It is objected to the British measures that they are imperfect, because, in the make up of the *rod*, a fractional number of *yards* and *feet* is made use of. The objection is a very short sighted one. 16.5 feet, or 5.5 yards make one *rod*. The *acre* is made by a rectangle 5280 feet, or one mile in length, by the half of one rod in width, or 8.25 feet, and 640 of these rectangles make one square mile. It will be observed that the length of one mile is 528 feet multiplied by 10; also, that the half of one rod is 8.25 feet, which, as *a number*, reads as the *reverse* or inverse of 528, indicating in feet the 10th of one mile. Is this peculiarity of inverse arrangement chance, or purposed? The latter, for they are changes derived from a common source, which numerically connects itself with the proportional elements of the circle, and those of the especial circle of 360 degrees alluded to. Divide 5280 by 256 and the quotient will be 20625, and divide 825 by 4 and the quotient will be 20625, the very number of the reported measure of the Nilometer Cubit. Thus, the number 20.625, in relation to our British mile, is an essential part thereof as a common factor in the make up of its denominations of measure, while 20.625 B. inches is, as seen measured as the recovery of the ancient Egyptian Nilometer Cubit. But the relation extends further. The late John A. Parker discovered the integral proportional relation, numerically, of circumference to diameter of a circle to be 20612 to 6561, the latter being the square of 81, which is the square of 9, which is the square of 3. This 20612, as 20.612 B. inches, has been shown to be the recovery of another ancient Egyptian Cubit, called the Turin cubit,* out of which springs the other or Nilometer cubit, thus: 20.612 B. inches : 6.561 :: 64.8 : 20.6264700 inches or the Nilometer cubit, in the last two terms of which proportion, we recognize the numbers mentioned above.

Now therefore, at the very center of a system of every variety

*This Egyptian cubit measure, in the Turin Museum, was measured with microscopic accuracy, by Bidone and Plana, and found to be .523524 of the French *meter*, or 20.61172 ÷ British inches; evidently from a great number of tests, and for convincing reasons, one of the two royal cubits, viz.: 20.612 inches, the other, as shown below, being 20.62647 inches.

and diversity of measures, we have *three* numbers *almost identical*, and each one a key to a variety or family of the system, viz: 20612, 20626.470017 and 20625. It was a part of ancient usage to obtain from simple numbers, easily carried in the memory, the use of fundamental ones. The number 20625 is easily had and easily discovered, and in our mound measures we have a key viz.: 12 and 21 feet. 7 times 21 feet is 147 feet, and 20625+.0000147 is 206264700, or one of the other numbers; while 20625 less 13 (and in the mounds we have a number of instances of the use of 13, in one especial instance, connected markedly with the numbers 110 and 210, pointing directly to this very use) is 20612, the third of the famous trio. Now all these shapes, measures and numbers, are presented in the Mound Builders constructions, and doubtless these very readings, were we sufficiently familiar with the use and relations of numbers, because the uses spring so easily, and naturally from the abundance of measures afforded, as the same measures are related to each other in construction. Everything points to the fact that the Mound Builders not only knew the *pi* relation, but also by use of the very numbers specified by their uses.

But, moreover, and what is a most singular fact, they did set it forth quite distinctly in a secondary and derivative form, and one which the writer has found to be used in the self same secondary way among the Asiatic ancients, which form is numerically, diameter 113, circumference 355.

This form is very ancient * and yet very modern. It is to be found in our elementary works. The established *pi* is 3.1415926, while this is 3.1415927.

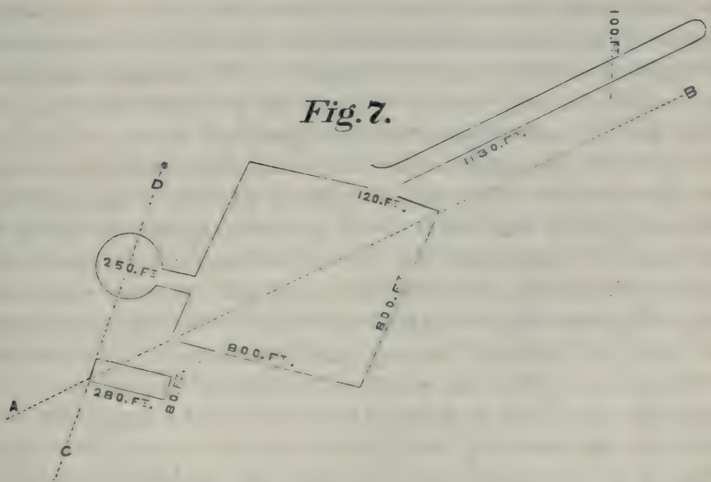
Such is what the writer judges to be a justifiable comment upon Groups I and II and III, together with this remarkable work of Seal Township, Pike County, Ohio. And now to resume the direct line of investigation thus interrupted:

As stated, the exceptions throughout the various works to the use of the typical numbers of measures is exceedingly rare; and

*It is found used in the books of Moses as a modified form of the *pi* ratio 6561 to 20612, and while the last is the base of a cubit measure, this one of 113 to 355, is used chiefly in matters of measures of time, especially in the symbolism of the scenes of Mt. Sinai. The multiple of this last ratio by 6 is 678 to 2130, which numbers are found in the Hebrew Bible as measures, (1) in the symbol of the circle of a "*head*," or the word RASH whose numbers are 213—(2) in the hieroglyphic use of the "*Dove*" and "*Raven*," whose numbers as used are 71×5 = 355, and the word "*and the-raven*," the sum of whose numbers is 678, and (3) in the zodiacal sign of the "*Two Fishes*;" the word "Fish" or *NUN* carrying the numbers 565, which multiplied by *two* equals 1130, and so on: which 2130 is the sum of 1080 and 1050 the measures found so typical and prominent in mound construction, in grouping different works, as seen

certainly one of the most noteworthy is to be found on Plate 23, p. 63. This exception embraces "The Dunlap Works," Ross County, Ohio. They lay within one mile of the Cedar Bank Works, and within two miles of the Hopeton Works, already cited; consequently they can be taken as partaking of the nature of, and as a connected branch of development of the works of the Scioto Valley, the Newark Works, the Marietta Works, and so on. They are situated on the right bank of the Scioto river, six miles above Chillicothe. The copy of the survey is given as Figure VII.

Fig. 7.



Upon examination of the original plan the construction is singular, though not noticed by the surveyors. A trial test line *a b*, parallel to the long way, is the diagonal of the irregular square, and extended locates the corner of the rectangular out-work, whose long side is parallel to one side of the square. Constructing the rectangular out-work, the extension *c d* of its short side passes through the center point of, and as to a part, becomes the diameter line of the circle attached to the square. Thus the measuring numbers of these various parts become related to each other by geometrical construction.

On the long way of 1130 feet it will be observed the surveyors have shown a line 100 feet long, as its height (of breadth) vertical to the horizon. The rectangular out-work is 280 feet long by 80 feet broad, and its area is 22400 feet, the half of which is

11200 feet, to which, if 100 be added, the sum is 11300 feet, or 10 times the length of the long way. The same may be shown in this way: The height of 100 feet taken from 10 times the length of the long way, or 11300 feet, is 11200 feet, twice which, or 22400 feet, equals the area of the rectangular out-work. By this we are led to look to the divisions of the figures, or component parts thereof, by 2, and the use of such parts by means of additions and subtractions to show intended interrelations. So also we are taught by all the measures of the groups: (1) that the reverse or inverse reading of key numbers is used to produce as keys, other and controlling and correlating relations, such as, 24 may be used as 42, 528 as 825, 21 as 12; (2) that key numbers are divided into other parts to apply to differing geometrical shapes, as for instance, 2400 feet, the length of a long way, is divided into 1250 and 1150 feet, to show the conjugate diameters of an ellipse, and so on.

To show the application: Part of *c d* forms, for such purpose, the diameter line of the circle, which is 250 feet long, and this naturally divides into halves of 125 feet each, to form the radii of the circle. By sympathy, 280 feet of the length of the out-work, connected, as seen, with this circle, and with the long way, may be divided into halves of 140 feet each, so that from these parts we have the numbers 140 and 125 thus desired. We see the number 8 used about the works as the digit of 80 and 800. Divide 1130 by 8, and we have 14125, which is the sum of the two numbers, 140 and 125, used as 140+00125=14125. Such relations show a purpose of checking, using and emphasizing the measures and parts of measures of the various parts by means of geometrical construction; but in this case all serve to concentrate upon and point to the number 1130.

But again take the measures and parts of measures of the out-work, located as a connecting constructive link between the 1130, and the 250 and 125 of the circle. 140 feet is 1680 inches, the eighth part of which is 210 inches, while 80 feet is 960 inches, the eighth part of which is 120 inches. Here we get the 21 and 12, which from the standard of 12 and 9 inches on the elliptical stone produce 1050 and 1080, the key numbers of the works in general; for $21 \times 5 = 105$, and $12 \times 9 = 108$.

What can there be of significance about the combined use of these two numbers, 1050 and 1080, fitting them to the scheme of common measure, adapted interchangeably to differing geometrical shapes, as, for instance, squares and circles?

Add together 1050 and 1080, and we have 2130. Divide this number by 6 and we have 355. We all know that 355 is the peculiar number, which, related to 113, gives in integrals the closest approximate numerical relation of diameter to circumference of a circle ever discovered in modern times, until John A. Parker found that of 6561 : 20612. And this seems to be the intended teaching of this group of the Mound Works.* It affords the numbers by which the geometrical relations of squares and circles can be interchangeably related or compared; while the other groups make such relations and comparisons, by the units of the standard practically adopted for actual measure. Which units refer to a basis of numbers by which measures of space and time may be correlated on squares and circles. The whole scheme, so far as geometry and numbers are concerned, is one which would naturally develop with all or any parts of the human race, independently of location, climate or family. That which could not be so developed would be the *practical unit of measure* adopted by which all relations might be shown in constructed works. We may adopt it as a truism that all peoples making use of this practical unit of measure must have derived it from a common source. The Mound Builders possessed it, so did the Old Egyptians, Hebrews, Romans, and, in modern times, the British people.

Group V.

This somewhat long and analytical investigation can now be appropriately closed with a description of the famous Newark Works, Licking County, Ohio, Plate 25, p. 67; upon the detailed measures of which the greatest pains were bestowed by Mr. Charles Whittlesey, Mr E. G. Squier, and Dr. E. H. Davis.

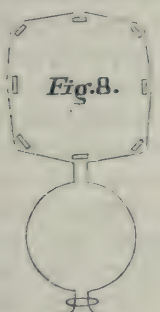
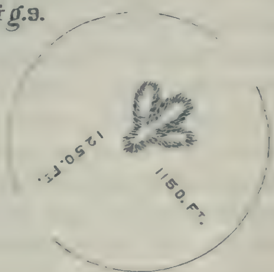


Fig. 8.

Fig. 9.



*While 1130 denotes a diameter to a circumference of 355x10, if 1130 be taken as a circumference value, it will in whole numbers indicate (with a decimal expression) a diameter of 360. With the Egyptians the Hebrew term Pharaoh was the number 355, the lunar year; which year was with the Hebrews the word *Shanah*, which carried this numerical value in the value of the word, while with both Egyptians and Hebrews they had the year of 360 days. The smaller lunar year of 354 days was "Pharaoh's daughter."

As to the plate it is said by the authors: "The map here given is from an original and very careful and minute survey made in 1836, by Charles Whittlesey, Esq., Topographical Engineer of the State of Ohio, corrected and verified by careful re-surveys and admeasurements by the authors. It may be relied upon as strictly correct." The chief object of giving this work is to show that the numbers of measures, viz., 24 feet, heretofore used on right lines, are transferred to designate the circumference of a circle. In the Hopeton Works we have a parallel way 2400 feet in length, connected with the great circle whose diameter is 1050 feet, and with the great rectangle whose side is 1080x10 inches. The especial feature of the Newark Works is the great circle of 24x120 =2880 feet in circumference, and the great ellipse whose conjugate diameters are, respectively, 1250 and 1150 feet in length. It will be seen that the sum of these diameters is 2400 feet, 12 times which is 10 times 2880, the circumference of the great circle, while their difference is 100 feet, or 1200 inches; so that the ellipse is made to be related to the circle by the length of the sum of its conjugate diameters. The circle, as is seen, Figure VIII, has a circumference of 2880 feet. Of it the authors say: "Unlike the other circular work, *this is a true circle*, two thousand eight hundred and eighty feet, or upwards of half a mile in circumference." It is connected with the octagon by a passage way 300 feet long by 60 feet wide. Recess to "Crown Works" 100 feet, about. Length of mound across crown work 170 feet. Within the octagon there are 8 mounds, rectangular truncated pyramids, each 100 feet long by 80 feet wide at base, and 5 feet high. Here at once, the relation of these works within the octagon to the cirumference of the circle becomes manifest, 100 feet is 1200 inches, 80 feet is 960 inches, and 5 feet is 60 inches, $960 \times 120 = 115200$, the $\frac{1}{40}$ of which is 2880 inches, the number, in feet of the circumference of this circle. So, also, the the octagon is a shape of 8 sides, and $2880 \times 8 = 23040$ which is 11520, or the area of the base of one of the mounds in the octagon, multiplied by 2. Moreover, this relation is also extended to the conjugate diameters of the ellipse. The sum and difference of 1250 and 1150 are, respectively, 2400 and 100 feet, or 28800 and 1200 inches, and the sum of the sum and difference of these is 57600, two-tenths of which is 11520, and the $\frac{1}{20}$th of which is 2880.

The ellipse is especially remarkable for the so called "bird

structure" which it contains, and its measures. As the circle is connected with an octagon, so the ellipse is connected with a square. The "bird mound," in the centre of the ellipse, affords, by reason of the measures of its various parts, a table of selected measures, the most of which are of familiar use throughout the groups in the valleys. It affords a table of typical measures. The description is as follows: "It can hardly be called a mound, but is rather a group of four, so arranged and connected as to constitute an unbroken outline. Denominating the figure, for the sake of distinction, a bird, the dimensions are as follows: Length of body 155 feet; of each wing 110 feet; (difference 45 feet); between the tips of the wings,* measuring in a right line 200 feet, width of body 63 feet; of wings, in centre, 45 feet; of same next the body 40 feet; height of mounds composing the body, 7 feet; of mounds, composing the wings, 5 feet. The head of the bird points directly towards the entrance of the enclosure. The bearing of the body is S. 65° E." Seriatim, the same measures in inches are 1860, 1320, 2400, 756, 540, 480, 84 and 60 inches. Here are the roots of our typical measures. $\frac{630}{6}=105$ and $63+45=108$. 110 is of itself one, and $110\times12=1320$, which is used; and $1320\times4=5280$. $105+108=213$, and $\frac{2130}{6}=355$ which, with 113, measures the elements of the circle.

And now let us notice the fact of an identity of measures, by means of numbers of measures applied to geometrical relations, of these works with those of The Great Egyptian Pyramid. We have identity of idea, identity of inter-relation of geometrical shapes by common numbers, and *identity of the unit of measure* to accomplish this; a strange combination when we think that this identity applies to works on two separate continents; to one structure called the "wonder of the world," the evidence of the height of civilization, removed back in time beyond history, and to others which belonged to a race removed in time far back of the Egyptians, a race whose bones in the valleys are so "*very dry*," as to have

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*The use of *wings* calls to mind the Hebrew "*cherub*," which, in its great variety of forms, had one common feature, viz.: these "*wings*;" and these were certainly used as types of measure, (1), in the division of the length of the ark of the covenant, or 2.50 cubits, into two parts, viz.: 1.25, and 1.25 cubits, which division indicated the use of the two stones which were placed therein (*abn*, 125, *abn*, 125). These were to indicate, in connection with the name Jehovah and Sinai, the measure of the lunar year, for: the sum of the squares of the two sides of a square, the side being 354.367054, the exact value of that year in days will be 521125, the square root of which will be 5011500, the diagonal of the square, a purposed change on the numbers of Jehovah's name and Sinai, to monument this astronomical value, and (2), in the division of the 20 cubits of the Holy of Holies by the wings of the cherubim. In the Hebrew Bible the ratio 113 to 355 is called "*The man (113) even Jehovah measure*."

turned to powder, and a race which as yet had no tool to cut stone to build into their structures as the Egyptians did.

The diameter of a circle whose circumference is 2880 feet, is 916.7320+ feet, and 2880 is a multiple of 24, for $24 \times 120 = 2880$. We have seen how intimately the numbers 1080 and 1050 are connected with 24 and 42, and how favorite a use the reversals of numbers are, as 12, 21, 24, 42; and so we might note it of 105 as 501, and 108 as 801.

Now the base side of The Great Egyptian Pyramid is 763.943+ feet, or diameter of a circle whose circumference would be 2400 feet. 763.943+feet is 9167.320+inches, which number, divided by 10, is 916.7320, or in feet the diameter of the Newark Mound circle. But we can carry the connection further. The half base side of The Great Pyramid is 381.971+ feet, and $\frac{9}{10}$ths of this is 343.7745+feet. This is the length of The Descending Passage Way, in the pyramid. But 343.7745+is the diameter of a circle whose circumference is 1080, and 3437.745+*minutes*, is radius minutes of the circle whose circumference is 360 *degrees*. All the interior construction of the pyramid is built upon the use of the length of this passage way, which is 200 Nilometer cubits. So, also, the Hebrew divisions of time, the least and greatest, in the year, were embraced by the number 1080 (Basnage).*

One word more and we will finish. The reversed use of numbers is a favorite one with the old Hebrews in their Sacred Records. Here, with the Mound Builders, the writer finds it again, and these are the only instances of his finding it, with the one solitary exception of the measures of the rectangular area to make one British acre, wherein such area is $528 \times 10 = 5280$ feet long by 8.25 feet in width, the numerical value 528 being reversed to 825 (8.25 feet being the half of one rod).

After the close of the above, the writer visited Col. Charles Whittlesey, in Cleveland, Ohio, who personally assured him of the accuracy of the measures of the mound works referred to in the foregoing. He also stated that he, himself, had a manuscript lately completed, his own independent attempt at finding the standard of measure of the Mound Builders. He obtained it by finding an even factor which would apply in common, with various multiples, to some eighty measures of the mounds, selected as within his own

*That is, with the Hebrews, their least measure of time was the division of the hour into 1080 *chiliakim* or scruples, while the sum of the measures of the great circles of time were, 355 days for the lunar year, 360 days for the calendar year, and 365 days for the solar year, together $355 + 360 + 365 = 1080$ days.

knowledge to be relied on as accurate. This manuscript he shortly after published, and as I now recollect, found upon measuring his "*factor measure*," that it was 30 British inches. By this it will be seen that two trials for such a standard, independent of each other, result in finding exact multiples of a common unit, viz.: the *British inch.*

APPENDIX A.

The History of the "Gridley Measuring Stone," or the Elliptical Stone found in the Fifth and Mound Street Mound, in the City of Cincinnati.

In the collections of Indian relics belonging to the Cincinnati Society of Natural History, is a small one, each member of which bears the printed form of label belonging to the old society called The Western Academy of Natural Sciences, formerly existing in the same city. The members of this small collection are labeled as follows: "No. 3, Indian relics deposited by C. P. Gridley," "No. 5, Indian Antiquities deposited by C. P. Gridley." "No. 6, Mound relics deposited by C. P. Gridley." "No. 7, Mound relics deposited by C. P. Gridley." "No. 12, Mound, Fifth street, deposited by C. P. Gridley." "No 13, Mound, Fifth street, deposited by C. P. Gridley." Of these the semi-elliptical stone measure of the text, the measures of which are there given by 9 and 12 inches, is the one labeled as "No. 5." This group, or small collection, passed with the rest of the collections belonging to The Western Academy of Natural Sciences into the possession of the Cincinnati Society of Natural History on its organization, and has been in that possession ever since to this date, February, 1883. This collection so labeled, consists of three fragments and two entire specimens; the two that are entire, being, first, the semi elliptical stone measure, or the "Gridley Measure." and second, a fine slate relic, of a shape lately described by Mr. Gridley.

The current tradition relative to this group has been that it consists of relics which were found in the Fifth and Mound Street Mound. Little if any especial attention has ever been paid to these relics. They have to appearance nothing to attract more than a passing glance, and seem valuable only in the general sense of being veritable Indian remains pertaining to our locality. Be-

yond this current report no certainty attached to them until December 5, 1878. On that day Mr. C. P. Gridley called upon Dr. H. H. Hill, of Cincinnati, a member of and an officer of the Cincinnati Society of Natural History. Mr. Gridley's object was to obtain possession again of the mound builder relics above mentioned, which he had loaned the Western Academy of Natural Sciences, and which, as said, had passed into the possession of the Cincinnati Society of Natural History. It seems that Mr. Gridley had removed to the city of Springfield some twenty-five years previously, where he had since lived, and where he now, at this present writing, resides. Mr. Gridley made a statement to Dr. Hill as follows:

"CINCINNATI, December 5, 1878.

"Mr. C. P. Gridley, of Springfield, O., this day called on me and stated that he was for many years a resident of Cincinnati, but moved to Springfield 25 years ago. While living here, and during the time the mound known as the Sixth and Mound Street Mound was being cut down, he frequently dug in it to see what he could find. After it was cut through, exposing the bed of ashes, charcoal, etc., (described by others) in the bottom of the mound, he dug into the bank immediately over the center of the ash bed, 3 or 4 feet above the level of the surrounding earth, and found some flint arrow and spear heads, two stone chisels, one slate ornament with a hole through it, several fragments of flat stone which he thought had been ornaments, and one flat stone with beveled straight edge, while the other was of an ovate form, wide at one end and running to a point at the other; length perhaps 10 inches; material fine grit stone—might be sand stone. 'At the request of Mr. S. T. Carley I deposited the above described relics in the collection of the Western Academy of Sciences, with the understanding that I could have them at any time he (I) wished to take them away.' He now wished to do so. After explaining to him how they were turned over to the Cincinnati Society of Natural History, and the difficulty of getting the matter satisfactorily before the parties concerned in the matter, he seemed to think it rather useless to attempt to get them. This interview was very satisfactory to me, as it settled in my mind the origin of the specimens, or, in other words, the fact that they were taken out of the mound known as the Cincinnati or Sixth and Mound Street Mound."

(Signed) "H. H. HILL."

While this statement was (as it is) of undoubted value as regards the relics, yet the exceedingly great value of the "Gridley Measure," as a discovered unit of measure belonging to the Mound Builders and the construction of the "Mound Works" of the Ohio Valley, made the writer collect all the facts possible with regard to it, and he wrote Mr. Gridley, receiving the following replies:

"SPRINGFIELD, CLARK CO., O., *Jan.* 29. 1883.

"DEAR SIR:—Yours of the 18th is received. In answer to your inquiries I would say that at the time of the removal of the mound I was residing on Longworth Street, near Mound Street, and often dug in it to find what I could. The relics were about 4 feet above the base of the same, and over a bed of ashes and charcoal, in which were found several skeletons partly in the ashes. I found the stone of this shape , and one with a hole in it, 2 stone chisels, and rough stone used to sharpen chisels on, and a copper ring which was on an arm bone of a skeleton. It broke in two after I found it and before I left it with the Antiquarian Society. If you will refer to Mr. Carley's antiquarian book you can find the day and date when deposited and the several items found. I believe they were found in the spring of '46. If you will call on the man who owns the lot he may be able to inform you of the year. As to the Gest stone, I believe it was found after mine. I think I saw it. The earth was deposited on Columbia Street or Second Street—the mound earth. If I could see you I could give you a description of what I found; but did not retain. I sold to Dr. Shotwell two skulls of singular form. A Mr. Clark was with Mr. Carley when I left the relics with the Antiquarian Society."

(Signed) "C. P. GRIDLEY."

The second reply is as follows:

"SPRINGFIELD, CLARK CO., O., *Feb.* 8, 1883.

"DEAR SIR:—In answer to your request I would say that it was over the center of the mound that I found these relics, and over the bed of charcoal of this form lying north and south 4x10 feet."

(Signed) "C. P. GRIDLEY."

Thus the location of the finding this measuring stone was at a depth of about 26 feet below the top of the ancient mound, and at or near its center, and the location of the find saves the relic from

any presumption of its belonging to a later, or what we call *intrusive,* deposit. As described by Dr. Drake, this mound measured 440 feet in circumference. A reference for the history of the removal of this mound, and for all that is to be gleaned as describing it, and the finding of the "Gest Tablet" is made to a pamphlet entitled, "The Prehistoric Remains Which Were Found on the Site of the City of Cincinnati, O., with a Vindication of the Cincinnati (Gest) Tablet," published by Robert Clarke, Esq., in 1876. The "Gest Tablet," which must always hereafter be associated with the "Gridley Measure," was, as per the descriptions in Mr. Clarke's valuable pamphlet, found at the center of the mound and about 4 feet above its base, so that the places of deposit of the two stones must have been very near the one to the other.

Mr. Gridley, having referred to Mr. S. T. Carley, who was a member of The Western Academy of Natural Sciences, and afterward a member of the Cincinnati Society of Natural History, I ascertained that Mr. Carley was a resident of Mount Holly, Clermont County, Ohio, and wrote him touching these matters. I received from him in reply the two notes following:

"MT. HOLLY, *Feb.* 4, 1883.

"DEAR SIR:

"Yours of January 31st received. I remember the circumstance of Mr. Gridley's depositing, in the collection of the Western Academy of N. S., a number of specimens of Indian relics subject to his demand. They were all labeled with his name. If the stone you allude to has his name attached to it, it is undoubtedly one of the lot he deposited at that time" (about thirty years ago). "At the time the Academy collection was transferred to the Society of N. H., nothing had been heard of Mr. Gridley for many years, so the specimens were thought of only as part of the collection. If Mr. Gridley should claim them, I have no doubt but the Society of Natural History will do what is right and just in the case. If the stone is of any special value, it will be worth more in a general collection than it could be in the hands of any single individual.

Respectfully,

(Signed) S. T. CARLEY."

"MT. HOLLY, *Feb.* 9, 1883.

"DEAR SIR:

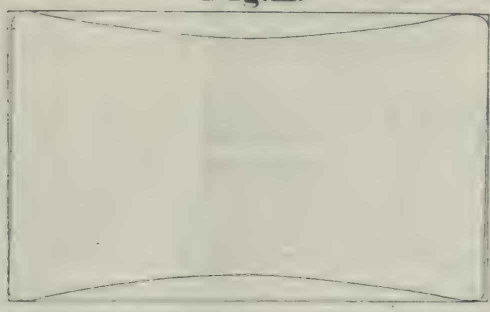
"It is with pleasure I acknowledge yours of the 5th, as it enables me to understand your purpose. Such a book as is referred to by Mr. Gridley" (the 'antiquarian book') "does not exist, but the records of the Academy of N. H. ought to contain an account of the transaction with Mr. Gridley, which must have occurred about the time you mention ('41). I remember the circumstances of the transaction distinctly, and I also remember the particular stone referred to. Mr. Gridley was in the habit of showing me his findings from the Fifth St. mound, so I feel sure the specimens deposited in the collection by him were found in that mound. Mr. Gridley could have had no motive to deceive any one in regard to the place where the stones were found. Besides, he was too honest to have done so. I know he went very often to the mound in search of relics, and I sometimes went there with him, but I never found any implements, but I once found three human skeletons, each lying on the back, extended, and the skulls of all three were crushed in from back to front, which I consider an unusual and interesting fact.

Respectfully Yours,

(Signed) S. T. CARLEY."

With this history of the Gridley Measure, we give Figure X the actual measures of the Gest Tablet, *reduced to half size*, taken

Fig. X.



from the slab itself, as referred by try squares to a perfect rectangle. By calipers the measures of the stone are as follows: Extreme length 4.96–7 inches. Greatest width 2.99 inches. Least width 2.50 inches. Corrected by being referred to a perfect rectangle,

its measures are: Extreme length exactly 5 inches. Greatest width 2.99 inches, least width 2.50 inches. Chord of shallow arc on each side 4.50 inches.

Since writing the foregoing my attention has been called by Dr. Hunt, president of the Society of Natural History, to an article in the May number, 1843, of the "American Pioneer," published in Cincinnati. This article describes and figures the Gest tablet, and the Gridley relics, those referred to in his letter above, which include the "*measuring stone*," the subject of our main article. It speaks of "Figure 1" (the Gest tablet) as a carved stone, found at the bottom, and near the center of an ancient mound, "now being removed from Mound Street near Fifth, this city." The mound is described as about 25 feet high. From the place where this was found, "about ten feet distant in the mound, and nearly on the same level, were found parts of another skeleton, with a beautiful stone ornament four inches long, two inches wide and nearly an inch thick (figured), also, *a stone* instrument nine inches long and three wide (figured); this is about a fourth of an inch thick. The long straight side has a diamond shaped edge, as if it had been used for dressing leather. These (with others described) were discovered by and are in possession of Mr. Gridley of Longworth Street." The article says the Gest tablet was taken from the mound in 1841, and this, with Mr. Gridley's statement, fixes the date of the find of the "measuring stone."

APPENDIX B.

The following quotations are made from the The Smithsonian Report of The Ancient Monuments of the Mississippi Valley, to establish as far as possible the facts: (1) Of care and accuracy in the measures of the mounds; (2) Of identities and correlations of groups and measures, such as to prove in the minds of the surveyors, the possession by the Mound Builders, of a standard of measure, and some means of taking angles correctly; also a scientific and religious object in the construction of the works, and (3) Of a further proof of the correctness of the measures as surveyed.

As to taking and reporting the exact measures of the various works:

"Indeed, no exertion was spared to insure entire accuracy, and compass, line and rule were alone relied upon in all matters where an approximate estimate might lead to erroneous conclusions." Introduction page 34.

"These plans are all drawn from actual and minute, and in most instances personal survey, and are presented, unless otherwise specially noted, on a uniform scale of 500 feet to the inch. When there are interesting features, too minute to be satisfactorily indicated on so small a scale enlarged plans have been adopted. Sections and supplementary plans are given whenever it is supposed they may illustrate the description or assist the comprehension of the reader. The greatest care has in all cases been taken to secure perfect fidelity in all essential particulars." (Page 10.)

"To put all skepticism at rest, which might otherwise arise as to the regularity of the works, it should be stated that they were all carefully surveyed by the authors in person. Of course no difficulty existed in determining the perfect regularity of the squares. The method of procedure in respect to the circles was as follows: Flags were raised at regular and convenient intervals upon the embankments, representing stations. The compass was then placed alternately at these stations, and the bearing of the next flag ascertained. If the angles thus determined proved to be coincident, the regularity of the work was placed beyond doubt." (Page 57).

"The square or rectangular works attending these large circles are of various dimensions. It has been observed, however, that certain groups are marked by a great uniformity of size. Five or six of these are noticed in the succeeding pages; they are exact squares, each measuring 1080 feet to the side, a coincidence which could not possibly be accidental, and which must possess some significance. It certainly establishes the fact of some *standard of measure* among the ancient people, if not the possession of some means of determining angles." (Page 48.)

As to the plan of the Newark Works, in foot note to page 71: "A number of plans of these works, as well as of those at Marietta, have been published; but they are all very defective, and fail to convey an accurate conception of the group. The map here given is from an original and very careful and minute survey made in 1836 by Charles Whittelsey, Esq., Topographical Engineer of the State of Ohio, corrected and verified by careful re-surveys and

admeasurements by the authors. It may be relied on as strictly correct." A similar explanation is made on "page 73" as to the plan of the Marietta works.

But apart from these statements of exactitude there is a proof of it to be had from the measures themselves. The works consist of groups, in some instances separated from each other by many miles, yet on the compilation from the field notes it soon became manifest from the surveys that there was identity of groups and measures as stated. Thus besides the care taken in the admeasurements of individual groups, justification was found in the agreement of measures of these with other and similar groups, upon which equal care had been bestowed This statement is made by the authors.

As to the coincidences of measures:

"It is not to be supposed that these numerous coincidences are the result of accident." (Page 71.) "Although in the progress of investigation singular coincidences were observed between these works, yet there was at the time no suspicion of the identity which subsequent comparison has shown to exist." (page 56.) Again: "There is one deduction to be drawn from the fact that the figures entering into these works are of uniform dimensions, which is of considerable importance in its bearing upon the state of knowledge among the people who erected them. It is that the builder possessed a standard of measure and had some means of determining angles. * * The coincidences observable between them could not have been the result of accident, and it is very manifest that they (the works) were erected for common purpose. What the purposes were the reader must judge. Without entering into any argument upon the subject, we may content ourselves with the simple expression of opinion that they were in some manner connected with the superstitions of the builders." (Page 61.) As to a *unique* work in Seal Township, Pike County, Ohio, they say: "It is impossible to resist the conviction that some significance attaches to these singular forms." (Page 67). As to the Portsmouth works they say: "Whatever may have been the divinity of their belief, order, symmetry and design were among his attributes; if, as appears most likely, the works that most strongly exhibit these features were dedicated to religious purposes, and were symbolical in their design." (Page 82.) As to the works in Montgomery County, Ohio: "It tends to confirm the impression produced by the other works that some significance attaches to the combination

of the two circles and the square." (Page 83.) As to the Newark works: "Several extraordinary coincidences are exhibited between the details of these works and some of those already described. The smaller circle F is nearly identical in size with that belonging to the "Hopeton Works," and with the one attached to the octagon in the High Bank group (see plates xvi. and xvii.) The works last named are situated upon the Scioto, seventy miles distant. The square has also the same area with the rectangle belonging to the Hopeton, and with the octagon attached to the High Bank works. The octagon, too, has the same area with the large irregular square at Marietta. The small circles, G, G, G, betray a coincidence with the works above mentioned, which ought not to be overlooked. It is not to be supposed that these numerous coincidences are the result of accident." (Page 71.) So on page 66 they say: "It will be remarked that we have here the square, the circle and the ellipse, separate and in combination, all of them constructed with geometric accuracy."

We have still another series of measures which go far to confirm the accuracy as to those given of the groups of works quoted. Many of the tumuli covered *altars*, so called, located generally on the ground level, and at the center of the mounds in which they were respectively built. These altars were curiously constructed. The shape was first marked out, and a portion of ground dug out to the depth required. This space was filled with sand, beaten down very compactly. Fire was used upon this until the substance of the altar became solidified to a mass, preserving its shape and substance, as if a solid stone. Above this, quite often, another, and sometimes a third altar was constructed, of definite regular shape, followed by the same use. Over these finally the earth was heaped and the mound formed. By this the altar in its integrity would be preserved for any number of years. The measures of some of these altars, as they are stated in the article on "Sacrificial Mounds," commencing with page 144, are as follows: "No. 1. A circular base 9 feet, or 108 inches in diameter, diameter of top 3 feet, or 36 inches, depth 9 inches. No. 2. Rectangular base 10 feet, or 120 inches long, 8 feet, or 96 inches broad. Top 6 feet, or 72 inches long, by 4 feet, or 48 inches broad, height 18 inches. No. 3. Square base 10 by 10 feet, top 6 by 6 feet, and a circular bowl in this of 4 feet in diameter. Depth of altar 22 inches, sinking a foot or more below the original surface of the ground. No. 4. Second and upper altar 8 feet by 8 feet." Here,

the application of the small measures, in inches and feet, is as natural to us as if these units of measure had been used by the ancient builders, and seems to comfirm the measures reported of the large works in the open.

The extreme antiquity of the works is marked by the frail decayed condition of the bony structure of the remains, and this is to be emphasized because of their perfect protection from chemical disintegration and other wear since the time of their deposit. To somewhat illustrate the duration of bony structure: Schlieman, at the Agora in ancient Mycenae, found the tomb of Agamemnon containing several remains. The bodies had been carefully interred and protected, partly by gold masks. "The bones and even the skulls had been preserved; but these latter had suffered so much from the moisture that none of them could be taken out entire." The Trojan war has been estimated at about 1700 B. C., or about 3600 years ago. The remains in the ancient mounds, such as those of the mound in question, are too much reduced to dust for preservation, save the jaw bones and teeth.

PAPERS ON THE DESTRUCTION OF NATIVE BIRDS.*

FIRST PAPER,

By Mr. Chas. Dury.

(Read at Special Meeting, May 25, 1886.)

In the year 1861 I first became interested in birds, and particularly those of the vicinity of Cincinnati. During the twenty-five years passed since then a great change has taken place in the Avian fauna of this locality. Then the beautiful wild pigeons, in their autumn migration, came over this country in countless myriads, but for the last three or four years none have been seen. and even the far-reaching market shooter has failed to furnish any for sale. They have been exterminated in this locality. From 1860 to 1870 geese, ducks, snipe and other water birds passed over in swarms to and from their breeding grounds in the North. They, also, are fast sharing the fate of the pigeons, as hardly two in a hundred of former numbers remain. As late as 1875 several covies of quails lived within the limits of Avondale, of whose numbers not a survivor now remains.

Change of habitat and cheap and improved shotguns have wrought fearful destruction among our beautiful game birds.

The inventors who are continually improving the killing qualities of breech-loading and repeating shotguns would do well to turn their attention to inventing some method by which the game the guns are to be used on can be saved from complete destruction. Florida, perhaps, better than any other State in the Union, shows the work of the destroyer, and in a shorter period of time. When I first visited that State in 1875 with some gentlemen of the Cuvier Club for the purpose of collecting some specimens of birds and fishes for the club's museum, we were astonished at the great number of beautiful aquatic birds we saw at all suitable places.

The egrets, herons and pelicans congregated by thousands in the rookeries. The snowy plumage of the egrets as they perched in the dark foliage of the mangroves gave a color to the landscape. The hand of the destroyer had but begun the work of destruction.

*The eight papers following were read as noted in the proceedings. Most of them were published in the Cincinnati Commercial-Gazette soon after their presentation to the Society. They are reprinted entire at the request of a number of members of the Society.

From the decks of the river steamers was fired a constant fusilade of rifle balls and shot, directed at every bird and alligator that showed itself. Of those killed or wounded none could be secured by the vandals who so cruelly murdered them—they were left to rot where they had fallen. Three years later when I again visited these localities the birds had greatly diminished, in fact it was difficult to secure specimens of some of the species which were before so abundant. During the winter just past several gentlemen of the Cuvier Club went over the same ground and report the work of destruction completed, the rookeries silent and deserted, the occupation of the professional bird slayers gone.

Dr. Henshall says during his last trip to the west and south coast of Florida he met the agent of a Boston milliner, who had brought with him fifty breech-loading guns and a large supply of ammunition. These he distributed among the residents, with orders to shoot as many "plume birds" as possible, for which he would pay them liberally, as he had orders to secure fifty thousand.

I visited a pelican rookery near Ft. Capron, on the Indian River, and was horrified at the sight I saw there. Scores of dead parent birds were floating in the water and scores of helpless young ones starving in their nests; and this infernal outrage inflicted in the name of sport by a party of so-called gentlemen sportsmen from the East.

Mr. Henry Hanna says, when he first visited St. Augustine, fifteen years ago, the cerlew, godwits and other shore birds were so abundant that the sportsman could, in a few hours at low tide, shoot as many as he could carry away. On the same ground during the past winter he did not see a shore bird! Similar reports come from all localities that were once famous for their bird life. Deserted rookeries and depopulated beaches are hideous monuments of the wanton destructiveness of the American tourist and the plume-gathering wretches who cater to the depravity of fashion.

I visited a dealer in bird skins, in New Jersey, with whom I was well acquainted, and saw in his stock thousands of birds and parts of birds. He had our beautiful native blue birds put up for hat and bonnet ornaments by the bushel. I was astonished that there were so many blue birds in the State as he exhibited, and he assured me there were some left yet, which he and his agents had not yet secured, owing to the interference, as he expressed it, of

some game clubs who threatened him with prosecution if he did not stop his inhuman work.

He was particularly severe on the scientific men, as he called them, who criticised his methods and only bought from him one or two of a kind. The demands made on him by the milliners were so great that none were obtainable for scientific specimens. I have always found that when the pocket-book of science and the pocket-book of fashion come in competition, science gets left every time.

A lady of this city, who deals in feathers for decorating head-gear, sent for me recently to look over a large case of birdskins she had just received from Texas. This case contained hundreds of meadow larks and many other birds, so badly prepared, dirty and greasy as to be completely worthless for any purpose whatever—a complete waste of so many valuable birds' lives.

The lady who had received the box, to her credit, said: "What a shame to kill such a lot of birds. I wish they would end this stupid bird-wearing fashion."

Neither rarity nor exquisite song has been any safeguard to shield a species from giving up its valuable life to the insatiable demands of fashion. I have seen hundreds of yellow-breasted chats, and the sweetest of American songsters, the wood thrush, wired and mutilated almost beyond recognition for this devilish purpose.

Bunches of wings of the European skylark prove that even it has not escaped the general destruction. Think of killing such a bird for such a purpose! A creature that has inspired many of the poets of the British Isles, and of whom Jas. Hogg, the "Ettrick Shepherd," has written:

I.

"Bird of the wilderness,
Blythsome and cumberless,
Sweet be thy matin o'er mountain and lea;
Emblem of happiness,
Blest in thy dwelling-place,
Oh, to abide in the desert with thee!
Wild is thy lay and loud
Far in the downy cloud,
Love gives it energy, love gave it birth;
Where on thy dewy wing,
Where art thou journeying?
Thy lay is in heaven, thy love is on earth.

II.

"O'er fell and fountain sheen,
O'er moor and mountain green,
O'er the red streamer that heralds the day,
Over the cloudlet dim,
Over the roinbow's rim,
Musical cherub, soar, singing away!
Then when the gloaming comes,
Low in the heather blooms,
Sweet will thy welcome and bed of love be!
Emblem of happiness,
Blest is thy dwelling-place,
O to abide in the desert with thee!"

I have not mentioned why birds should be perpetuated. Either from an æsthetic or economic point of view, birds are of the *utmost* value, and to all persons of average intelligence this fact is too apparent to need mention.

In the supplement to Science of February 26, 1886, Mr. J. A. Allen, of New York, has one of a number of very able papers on the destruction of bird life in the United States. In this paper he speaks of one of the important agencies in bird destruction as the "small bad boy"—and in an ornithological sense his name is legion—of both town and country. Bird-nest robbing is one of the besetting sins, one of the marks of natural depravity of the average small boy, who fails to appreciate the cruelty of systematically robbing every nest within reach, and of stoning those that are otherwise inacessible. To him the birds themselves too are a fair target for a stone, a sling or a pea shooter. To the latter many a sparrow, thrush or warbler falls a victim. Two ten-year-old lads in Bridghampton, L. I., confessed this autumn that with these rubber pea shooters they had killed during the season fifty robins and other birds which frequent the garden, orchard and cemetery. I can bear abundant testimony to Mr. Allen's statememt. For twenty-seven years I have lived in a large country place filled with trees and birds, which we have protected to the best of our ability from the depredations of cats and small boys. Whenever I got a chance I removed the cats with a shotgun and accelerated the departure of the bad boy with anything throwable that came handy. This spring I have seen several dead and crippled birds around the place that I know were victims of the deadly pea shooter. A few days ago as I stood unobserved in a cluster of bushes a rock whizzed past my head, thrown at a cat bird by a trespassing young

vagabond, and I have given thanks ever since, as the clod which I hurled back at him hit him square in the ribs and nearly knocked the breath out of him. As he made off, he looked around, wondering where the clod could have come from. In Mr. Allen's article above mentioned he quotes a recent writer in saying, "A garden without flowers, childhood without laughter, an orchard without blossoms, a sky without color, roses without perfume are the analogues of a country without song-birds. And the United States are going straight and swift into that desert condition." It is useless to talk about laws for the protection of our song-birds: we have had for years good laws on the subject, but it is impossible to enforce laws where it is so difficult to catch and convict the offenders. So long as there is a demand for these birds just so long will the market be supplied, law or no law. It all depends on the ladies who wear birds for decoration whether our beautiful songsters shall be exterminated or not.

SECOND PAPER.

By Wm. Hubbell Fisher, Esq.

(Read May 25, 1886.)

Life is a wonderful and mysterious thing. Man may take life, he may blot it out, but he can not give it back to the lifeless clay. Has he a right to take life? That he has the right to take the life of his fellow-being for any reason whatsoever is denied by some. The majority of the people of civilized communities have held that capital punishment—the taking of the life of the one who commits the capital crimes of murder or treason—is not only justifiable but necessary for the prevention of like crimes by others; that any others among the remainder of the people having a wish to commit these crimes, seeing justice thus swiftly and thoroughly administered, will take warning and desist from their committal.

In some countries arson is punished by death, while, on the vast plains of the great West, horse-stealing is punished by death by the unanimous verdict of the people, for the reason that detection is difficult, catching the prisoner alive is difficult, and more particularly that capital punishment there appears to be the surest and most effective means of extirpating a system of robbery which

attacks the article, the thing most necessary to the ranchman for the preservation of his own life and property.

Thus we see the legal taking of human life deliberately in civilized communities is founded upon a reason, and upon a deliberate and thoughtful one.

The taking of life of animals (other than man) ought to be founded upon good and sufficient reasons. These reasons may be grouped under one great division, viz.:

The preservation of man himself.

This includes—first, the destruction of those animals which either directly destroy the man himself or destroy his food or other things essential to his life and welfare; and secondly, the taking of the life of animals useful to him for food or clothing. As to wild animals of the cat tribe, from the lion and tiger down to the wildcat, the various species of wolves, the bears and many other species of quadrupeds, many of the species of snakes, the crocodile, the alligator, the man-eating shark—about all these and others of like ferocity the question of the right to take their lives can not arise. The right is too clear for question. Under this category none of our birds can fairly be classed, it being a remarkably rare instance in which any bird, even though of the hawk kind, or the owl kind, or the eagle, attacks man.

Hence the right to take the life of our birds can not be based upon the reason that they attack man or that the man needs to destroy them because they will directly attack him.

Let us look at some of the animals in the light of the proposition that the life of those animals which destroy the food of man, or other things essential to his life and welfare, should be destroyed. The weasel and fox and like animals which destroy our domestic poultry, and thus waste, diminish and destroy our food supply, certainly belong to this class.

How is it as to birds? First, as to the hawks and owls. Not long ago the great State of Ohio, following in the train of some of her sister States, enacted stringent laws for the destruction of hawks, offering a premium for the head of each hawk, delivered, of fifty cents. This bountiful reward attracted great attention, as it amounted to paying more for a rapacious bird than the pothunter or country lad could get by sending a duck or quail to market. Immense numbers of hawks were destroyed. Some were shot and some were trapped. A couple of hunters in New Hampshire secured for bounties a fabulous number of hawks. The

supposition has been that the hawks were the enemy of man; that they destroyed his poultry, particularly the smaller kinds, and were of no possible good or utility. Hence, one of the earliest recollections of the country boy is that the announcement of the presence of a hawk served to bring out the shot-gun, or caused the neighbor's to be borrowed, and immediate war upon that bird was the order of the hour.

Where ignorance is bliss is it not folly to be wise? Well, sometimes; but often it is folly not to be wise, as the bliss of ignorance soon changes into the sorrow and mortification of loss. It appears that on June 23, 1885, the Assembly of Pennsylvania passed an act for the destruction, among other things, of hawks and owls, and offered fifty cents per head for every hawk and owl, except the Acadian screech or barn owl.

The Westchester (Pa.) Microscopical Society took the matter in hand. They state that Dr. B. Harry Warren, Ornithologist of the Pennsylvania State Board of Agriculture, had devoted several years to the collection, dissection and examination of birds; and that "all of the committee from observation and experience have believed that all of the birds denounced in the law above quoted, with rare exceptions, have been found to be the best friends of the farmer." The committee further state that lest any of the committee might have been mistaken, "they have corresponded with the best ornithologists in the country, connected with the Smithsonian Institute, to-wit: Dr. C. Hart Merriam, Ornithologist of the United States Department of Agriculture," viz.: Of the Division of Economic Ornithology, whose special business it is to understand the relation and uses of birds to agriculture, and to each other, and to the welfare of man; "Robert Ridgway, Curator of the Department of Birds, United States National Museum; Dr. Leonard Stejneger, Assistant Curator of the same department; H. W. Henshaw, of the Bureau of Ethnology, also a collector of birds for the Smithsonian Institute and connected with the late Wheeler survey of the territories; and Lucien M. Turner, a collector of birds, etc., for the Smithsonian Institute for the last twelve years." The answers of these parties are annexed to the report and speak for themselves, and go to corroborate the report, viz., that "the hawks and owls are of great benefit to the farmer, and render him far greater service than injury, and that it is unwise to select any of them for destruction."

The majority of the species of hawks and owls live upon small rodents, as field mice and insects. The great horned owl sometimes preys upon birds, as do also the Cooper's hawk and the sharp-shinned hawks, but the other hawks live mainly upon insects and field mice and the like, as do also most of the owls. The beautiful sparrow hawk lives almost exclusively upon insects.

What did the committee do? They did just what they should have done, viz.: They passed resolutions to the effect that the act of June 23, 1885, offering a premium for the destruction of hawks and owls is unwise and prejudicial to the interests of agriculture; and they decided to request their members of the Legislature to aid in its appeal.

Two papers read before this society, one by Mr. J. W. Shorten and another by Mr. Charles W. Dury, give the results of these gentlemen's examination of the contents of the stomach of rapacious birds, and confirm the position taken by the society of Chester County.

The point I make here is this, that the farmer or poultryman has the right to shoot any hawk or owl he knows is depredating on his poultry. But it is not just for the State or for fashion to encourage the wholesale destruction of these birds.

We come now to that class of birds that eat cherries and other small fruits. The question is as to whether the birds do more harm than good the season through. If they do more good than harm, they should be spared and nourished. You see the question is not one of sentiment; it is one of dollars and cents and of pure business. Of course many of our feathered friends love berries. Where the main crop of the farmer consists of small fruit he is entitled to shoot the small marauders, and, what is more to the point and more effective, suspend pieces of tin by cords to be waved by the breeze, and other scarecrows. But the majority of farmers are not large growers of small fruits. One of the greatest enemies the farmer has to contend with are insects There are insects who eat his trees, working under the bark. Insects attack his wheat, his corn, the fresh leaves of his growing vegetables. What about the potato-bug, the locust, wholesale destroyers of the crops—the countless insects that live upon and destroy the flowers of the horticulturist and florist? Right here I will quote extracts from the remarks of Charles A. Green, Chairman Committee on Ornithology, W. N. Y. H. Society, Rochester, N. Y.:

"Fruit-growers and farmers do not appreciate the importance of the birds that nest in their fields and orchards, or follow the paths of their plows and harrows.

"There is great need for protection of birds, yet the average ruralist is not familiar with the name of one bird in ten that inhabits his fields, thus is not able to distinguish the most delightful songster or the most effective insect destroyer.

"Each living creature has its use in the economy of nature, and no species can be annihilated without disturbance of equilibrium. The flies are useful scavengers. Mosquitos, worms, snakes, toads, and all forms of life, were designed for a good purpose. One race may do service in keeping the other in check.

"There are birds worn by our city belles that alive would accomplish more good work for mankind than the average fashionable belle, although she lived for a century. The eyes and beaks of these dead birds cry out in shame against the cruel fashion that causes their slaughter.

"I once heard an intelligent fruit grower exclaim: 'Shoot the birds; they are eating my cherries.' Why not as well say, 'Shoot the horses, they are eating my oats; shoot the cows, they are eating my hay; shoot the chickens, they are eating my corn; shoot the children, they are eating my bread.' If the horses, cows, chickens and children are useful and desirable features of our homes, we must not destroy them; neither must we destroy the birds if useful and desirable.

"Five thousand miles is not a long distance for birds to migrate. They often breed in one locality and feast in another. But wherever they go, wherever they alight for a mouthful of food, the gun, trap, cat or robbers await them. How long will the race survive such treatment? Is this not a question worthy of consideration?"

There is one bird of the family of the fissirostal or split mouths, called in popular phrase the night-hawk (*Chordeiles Virginianus*). He is no more of a hawk than is a pigeon. He is entirely an insectivorous bird. When I was younger, I shot one of the birds. I skinned it, and, according to my custom, I examined his crop and found that it contained grass hoppers and other insects and nothing else, and enough of them to fill a half-pint cup about full. Now, to go on shooting this bird on the supposition that it was a bird which preyed upon other birds, would be more than a blunder, it would be a calamity to the

farmer. Most of our song-birds are insectivorous birds, and so are the woodpeckers. We therefore protest against the destruction of our birds, and think that they should be protected by public sentiment for the reason that they do more good than harm.

The increase of insects is marvelous. One insect may in one year become the progenitor of six billion descendants. Three hundred and twenty-five actual species of insects are known, and it is thought that there as many more species unknown. If undisturbed, insects would destroy every green thing upon the earth's surface, and men would perish; but nature has provided enemies, and prominent among them are the birds, which keep the insects in check without cost to the horticulturist.

"A swallow, as it skims through the air on a summer day, will destroy more insects than a farmer in the same length of time sweating over a heavy bucket of Paris green mixture.

"As the country became cleared of timber and more thickly inhabited, the birds have been destroyed in large numbers, and insects have gained the ascendancy."

The question of the destruction of birds for food rests upon a solid basis.

Certain kinds of birds, viz., many of the ducks and waders, are universally recognized as fit for food. To the shooting of these, under proper restrictions as to time and place, there appears to be no reasonable objection. As to one class of birds there exists a difference of opinion whether they should be eaten or not. At Hampton, Va., two and one-half miles from Fortress Monroe, I saw robins hung up for sale in the market. Alongside the cemetery at Richmond, in the same State, I saw a gunner stealthily hunting for robins. At the markets in the Nation's Capital, I have seen exposed for sale bobolinks—there called reed birds—stripped of their feathers and fastened together in bunches like radishes. I could not eat the birds. In New England the killing of these birds is prohibited, while in the South many sportsmen shoot them for sport, and thousands of them are eaten. The amount of food in one of these birds is so small that it seems an unequal equivalent for the destruction of such a sweet songster as is the bobolink, which James Russell Lowell so delightfully describes. And yet even the destruction of game birds for food has been so great that the hunter views with anxious eye their rapid disappearance. The prairie chicken (pinnated grouse), once so plentiful in

the Eastern part of the United States, has there become a thing of the past. So has the wild turkey, and to a great extent the wild pigeon. The vast number of ducks and waders, the snipe and the plover, have been perceptibly lessened. The great northern migration of most of these birds takes place through the central part of the United States, in the path of the Mississippi and her tributaries, and the great lakes, and occurs in the spring time.

At that time the birds are usually thin and poor, and are not very desirable for food. They are going north to breed, and the destruction of each pair then means the destruction of not only that pair, but another pair, and often several more pairs of birds which would follow the spring and summer hatch.

I am glad to notice that the new Ontario (Canada) game law forbids the killing of ducks and other water fowl between January 1st and September 1st; also snipe, rail and golden plover between January 1st and September 1st. It is is also pleasant to chronicle that the game clubs of the Central United States are moving in the direction of prohibiting spring shooting. Right here let me call your attention to a most ancient and interesting game law.

The law of Moses provides that every seventh year the land should have rest and what grew in that year was for the game. The inference is clear that the game was that year to be unmolested. [See Exodus 23, 11; Leviticus 25, 7.]

Michaelis, volume 2, page 419, says: "It is the command of Moses [Deut. 22, 6, 7,] that if a person find a bird's nest in the way, whether in a tree or on the ground, though he may take the eggs or the young, he shall not take the mother, but always allow her to escape. It is clear that he here speaks not of those which nestle upon people's property. * * * He merely enjoins what one has to do on finding such nests on the way, that is without one's property, thus guarding against the utter extinction or too great diminution of any species of birds indigenous to the country."

Many readers may think it strange that Moses should be represented as providing for the preservation of noxious birds: yet, in fact, nothing can be more conformable to legislative wisdom. To extirpate, or even to persecute, to too great an extent, any species of birds, from an idea of its being hostile to the interests of the inhabitants, is a measure of doubtful policy. It ought, in general, to be considered as a part of nature's bounty, bestowed for some important purpose; but what that is we certainly discover too late when it has been extirpated and the evil consequences of that

measure are begun to be felt. In this matter the legislator should take a lesson from the naturalist."

Linnæus gives two remarkable examples to confirm it. One, in the case of the little crow of Virginia (*Gracula Quiscula*), extirpated at great expense on account of its supposed destructive effects, and which the inhabitants would soon gladly have reintroduced at double the expense. The other the Egyptian Vulture (*Vultur Percnopterus*). This species of crow constantly frequented the pea fields, and to put a stop to its ravages its extirpation was resolved upon. As soon as this was effected, an insect of the beetle kind multiplied to such a degree that very few peas were left. A naturalist found that the crows were not in quest of peas, but only devouring the beetles.

As for the vulture, Linnæus says that these creatures of prey rid the earth of dead carcasses and make it wholesome and comfortable, besides serving to maintain a due proportion between the different animals, and to prevent any one kind from starving the rest.

In addition to this detail, I subjoin what follows in the same magazine, relative to the crow in Sweden: "At somewhat less expense the same truth was some time ago confirmed in Sweden. The common crow (*Corvus cornix*, Linn.) was thought to be too fond of the young root of grass, being observed sometimes to pick them out and lay them bare. Orders were therefore given to the people to be at all pains to extirpate them, till some person, more judicious, opposed this, and showed that it was not the roots of the grass, but the destructive caterpillars of certain insects which fed on them, that the crows searched for and devoured." [Michaelis' Laws of Moses, Vol. 2, p. 421 et seq.]

There is a great slaughter of birds carried on by the young boys. Near where I live, in the heart of the city, lives a boy who carries a stone slinger, and that boy in one day killed ten sparrows, eight of which fell to the ground alive, to use the phrase of one of his young companions—which meant wounded. Last evening, a lady, just from the suburbs of St. Louis, stated that, next door to where she was there staying, a small boy, ten years of age, had a gun, and got up early every morning and shot at everything of the bird kind he could see.

Probably some of you read the article in one of our daily papers lately in which the writer stated that when walking in the forests in the vicinity of this city, he saw a boy, accompanied by a

gentlemen, who was practicing shooting at the birds in order to become an accurate marksman. So the gentleman said, and, although the boy had only a simple air-gun, several birds fell dead, one of which was startled from her nest, in which were several eggs. There is no excuse for this wanton slaughter. The bird is not used for food nor the skin saved.

The last question to be considered is: Is the killing of birds authorized for the purposes of dress and fashion?

The killing of fur animals for their fur, to be used as clothing, is doubtless justifiable. But the skins of birds, particularly of our song birds, are too small to be thus utilized. The amount of life sacrificed to make a single dress of bird skins would be slaughter. Such dresses are not needed, would be very expensive, and not nearly so useful or economical as the textile fabrics of every shade and hue from the plain or figured calico to the gorgeous silks and elegant fancy stuffs now in use. But we are not called upon here to meet such a use of bird skins. We are to meet the use of bird skins and birds' heads worn, not for warmth or protection, but for ornament. The question is: Is this ornament in the highest and truest sense? I think not. I am not now referring to ostrich plumes, but to the heads and bodies fastened upon hats or located in the festoons of dresses and the like.

In the "Forest and Stream" of March 18, 1886, appears the following:

"The feather-decked hats reach their highest developement at the great gambling resort of Monte Carlo, where, according to the London World, the ladies' hats are as high as the play. Three girls, presumably sisters, and undoubtedly Americans not in society, attract an immense attention by reason of their showy garments. They wear very high conical hats, ornamented in front with large green and yellow parrots with glaring glass eyes. Each bird is perched on a little bough, and it is impossible to imagine anything more ludicrous or in worse taste. The girls are incessant talkers, and, my correspondent tells me, they are known by the nickname of the 'Prattling Pollies.'"

My brother lecturers this evening have given you many figures on this subject.

The startling truth is that a great portion of the supply of plumage does not come through the custom-house. Hundreds of thousands of birds slaughtered for trimming are American song-birds. From a single locality on Long Island were sent in during

the week ending July 26, 1884, over $300 worth of birds. The same man sent, during the season of four months, not far from seventy thousand birds.

Charles Dudley Warner, in a note to the Forest and Stream, writes:

"Your note about the Audubon Society followed me to Mexico and here. After this long delay, if it is of any service to you, I should be glad to be quoted as in entire sympathy with its object. A dead bird does not help the appearance of an ugly woman, and a pretty woman needs no such adornment. If you can get the woman to recognize these two things, a great deal will be done for the protection of our song-birds."

A writer in the Evening Post, of April 7, says: "My visit to the National Academy was spoiled yesterday. Not by viewing bad pictures, either. It was by a young lady's hat. There was nothing in her face to denote excessive cruelty. Indeed, she was very pretty, and the attention she paid to the best pictures seemed to indicate that her artistic taste was not uncultivated. But her hat! The front rim of this was decorated with the heads of over twenty little birds. I counted them at a risk of seeming to stare rudely. These heads were simply sewed on side by side as closely as possible."

Celia Thaxter writes to the Boston Transcript: "But women do not know what they are doing when they buy and wear birds and feathers, or they would never do it. How should people brought up in cities know anything of the sacred lives of birds? What woman whose head is bristling with their feathers knows, for instance, the hymn of the song sparrows, the sweet jargon of the black-birds, the fairy fluting of the oriole, the lonely, lovely wooing call of the sandpiper, the cheerful challenge of the chickadee, the wild, clear whistle of the curlew, the twittering of the swallows as they go careering in wide curves through the summer air, filling earth and heaven with tones of pure gladness, each bird a marvel of grace, beauty and joy? God gave us these exquisite creatures for delight and solace, and we suffer them to be slain by thousands for our 'adornment.' When I take note of the headgear of my sex a kind of despair overwhelms me. I go mourning at heart in an endless funeral procession of slaughtered birds, many of whom are like dear friends to me. From infancy I have lived among them, have watched them with the most profound reverence and love, respected their rights, adored their beauty and song, and I could

no more injure a bird than I could hurt a child. No woman would if she knew it.

"The family life of most birds is a lesson to men and women. But how few people have had the priviledge of watching that sweet life; of knowing how precious and sacred it is, how the little beings guard their nests with almost human wisdom, and cherish their young with faithful, careful, self-sacrificing love. If women only knew these things, there is not one in the length and breadth of the land, I am happy to believe, who would be cruel enough to encourage this massacre of the innocents by wearing any precious rifled plume of theirs upon her person. In New York one firm had on hand February 1, 1886, two hundred thousand skins. The supply is not limited by domestic consumption; American bird skins are sent abroad; one New York firm had a contract to supply forty thousand skins of American birds to one Paris firm."

As to the pleasure derived from the presence of birds, John James Audubon fitly expressed the sentiments of thousands of people when he said: "The moment a bird was dead, however beautiful it had been in life, the pleasure derived from the possession of it became blunted."

There is a pleasure derived from the song of the birds, an education resulting from their fellowship, that makes their living presence greatly to be desired. These facts, and their utility when alive to the agriculturist, turn the scale greatly in favor of their protection and preservation.

How shall we accomplish this? I answer: By influencing public opinion and sentiment. The people have hearts; they have common sense and a love of the beautiful, and can appreciate the appeal.

Celia Thaxter is right when she says: "Evil is wrought from want of thought." The women of this city and of our country must combine their efforts along with those of the men, to stop the demand for birds' heads and bodies, by leaving off wearing the same, and by discouraging the use of the same by others.

As soon as the demand stops the killing will stop, as it is money paid to the shooters and trappers that causes them to take these birds and engage in this wholesale destruction of bird life. All wanton destruction of bird life should be frowned upon. We have a State law that prohibits the killing of many of our song and insectiverous birds, but we need the law to be enforced by public opinion. Above all, let the purchase of the birds' heads,

bodies, and, for the most part, of birds' wings also, be discontinued.

Right here, in closing, let me explain to you the Audubon Society.

The purpose of the Audubon Society is the protection of American birds not used for food. To accomplish this purpose it will:

1. Secure and publish information to show the extent of the present enormous destruction of birds for millinery, decorative and other purposes.

2. Expose the outrageous and indefensible cruelty of such wanton taking of feathered life.

3. Point out the damage to the agricultural interests of the land which must certainly follow the decimation of the insectivores.

4. By thus presenting the subject in its ethical, humane and economic aspects, enlist the sympathy and active personal co-operation of a large membership in the effort to check the evil.

Three forms of pledges have been adopted, viz.: 1. To discourage the killing of any bird not used for food. 2. To discourage the robbing of any bird's nest or the destruction of its eggs. 3. To refrain from the use of any wild bird's plumage as an article of dress or adornment.

The Audubon Society certificate of membership will be issued to those who subscribe to one, two or all the pledges. Membership involves no expense whatever. There are no fees of any kind. The funds necessary to carry on the work are supplied entirely by voluntary subscriptions, the immediate expense for organization being borne by the Forest and Stream Publishing Company. The society has local secretaries in cities towns and villages. The local secretaries will furnish circulars of information and pledge forms; will receive the signed pledges, keep a list of the members, forward a duplicate list with the pledges for enrollment and file at the society's office, and will receive in return certificates of membership, to be filled out and signed by the local secretary and given to the members. No certificate of membership will be issed to any person except upon the receipt of a signed pledge at the office of the society. Where no local secretary has yet been appointed, individual applicants for membership may address the society at its office, No. 40 Park Row, New York.

The society furnishes to each member a handsome certificate of membership. This bears a portait of the great naturalist, John James Audubon, after whom the society takes its name.

WM. HUBBELL FISHER.

CINCINNATI, May 25, 1886.

THIRD PAPER.

By REUBEN H. WARDER, Esq.

(Read May 25, 1886.)

To the Society of Natural History:

All observing lovers of birds, and students of Natural History, have noticed with increasing anxiety the prevalent fashion of wearing bird skins for the decoration of ladies' hats and gowns.

It is probable that this custom would never have become so general if the wearers of fine feathers had realized the great destruction of bird life, to which the fashion leads. In order to prevent the further wanton "Murder of the Innocents," many of the ablest and most tireless, true birdlovers have used both pen and voice in appealing to the public to stop this slaughter. Some theorists reply that this is all sentiment and go on to deny that there has been any diminution of numbers of birds; they assert that birds are the natural prey and food of man; that no special destruction effects their numbers; that birds will continue to exist in spite of all that man does until they give place to something better, and so on. We admit that figures are, from the nature of the case, difficult to get, and more or less uncertain. But the fact remains that in addition to the ordinary and unavoidable destruction of birds, by their enemies, by changed conditions of life and by man, that fashion has demanded the killing of very large numbers of birds, of various sorts, of the most useful and highly prized species. We hold that this killing can not go on indefinitely without effecting the numbers and disturbing the natural balance of creation, in which birds perform so useful a part.

And, as this fashion is a merely idle and useless one, and so injurious in its effects, we ask the help of all members of this Society, all well disposed persons, to aid the movement now in progress to discourage all wearing of feathers for decorative (so called) purposes. We called on all who are interested to form Anti Plum-

age Wearing Societies, and to aid the Humane Society in its efforts to lessen this evil.

Until recently, attention has not been generally called to this matter, but now that the American Ornithologists Union, Committee on Bird Protection, have been doing such good work in this country in publishing the facts of the case, there is more knowledge on this subject.

Mr. Bicknell says:

"So long as the demand continues, the supply will come. Law of itself can be of little, perhaps of no ultimate avail. It may give check, but this tide of destruction it is powerless to stay. The demand will be met; the offenders will find it worth while to dare the Law. One thing, only, will stop this cruelty—the disapprobation of fashion. It is our women who hold this great power. Let the women say the word and hundreds of thousands of bird lives every year will be preserved. And until woman does use her influence, it is in vain to hope that this nameless sacrifice will cease until it has worked out its own end and the birds are gone. It is earnestly hoped that the ladies of this city can be led to see this matter in its true light, and to take some pronounced stand in behalf of the birds and against the prevailing fashions.

It is known that even now birds are not worn by some on grounds of humanity, yet little is to be expected from individuals challenging the fashion. Concert of action is needed. The sentiment of humanity once widely aroused, and the birds are safe. Surely those who unthinkingly have been the sustaining cause of a great cruelty will not refuse their influence in abating it, now that they are awakened to the truth. Already word comes from London that women are taking up the work there. Can we do less? It needs only united action sustained by resolution and sincerity of purpose to crush a painful wrong, truly a barbarism, and to achieve a humane work so far reaching in its effects as to outsweep the span of our own generation, and promise a blessing to those who will come after."

FOURTH PAPER.

By F. W. Langdon, M. D.

(Read June 1, 1886.)

Mr. President and Ladies and Gentlemen—In response to the request of a number of members of the Society, I have decided to continue the consideration of the subject of "Destruction of our Native Birds," viewing the matter from a somewhat different standpoint from that taken by the committee, whose interesting and instructive papers we listened to with much pleasure and profit at our last meeting. It seems to me that the other side of this question should at least have a hearing.

I propose, therefore, to discuss the subject so far as my limited time and ability will permit, from what is at present—perhaps deservedly so—the *un*popular side.

The main proposition sought to be established by the reports of your committee, the committee of the American Ornitholigists' Union,* and papers of similar tenor by various individuals, is—

That our song-birds, insect-eating species and smaller birds generally, are in danger of suffering a notable decrease in numbers, or even extermination, by reason of—

First—The demands of fashion for millinery and dress ornaments.

Second—The bloodthirsty disposition of the "bad small boy."

Third—The market gunner, or "pot hunter."

Fourth—The ornithological collector and student.

It shall be my aim this evening to direct your attention to some facts which show the extreme improbability of any such misfortune resulting from either of these causes, or from any others at present within our knowledge.

In support of the claim that the demand for millinery purposes is the chief cause of an anticipated extermination of song-birds, we find numerous high-sounding figures in the various papers referred to. Let us see what these figures are and to what birds they apply. Mr. William Dutcher† states (quoted also by your committee), "that 40,000 terns were killed on Cape Cod in one season; that at Cobb's Island, off the Virginia coast, 40,000 birds," mainly gulls and terns, were contracted for by an enterprising woman from New

* Vide "Science Supplement," Feb. 26, 1886, No. 100.

† Ibid.

York, to ship to Paris; that 11,018 skins were taken on the South Carolina coast in a three months' trip of one dealer; that seventy thousand were supplied to New York dealers from a village on Long Island. Note, if you please, that these large figures apply to "*coast*" birds, mainly or entirely, therefore composed of gulls, terns and the "shore" birds.

My friend, Mr. Geo. B. Sennett, is also quoted in this article as stating that he overheard the agent of a millinery firm endeavoring to make a contract in Texas for ten thousand plumes of egrets (a species of heron, or fish-eating wader).

Then, in another place, is an estimate that the number of grebes shipped, mainly from the Pacific slope of North America, must range far into the tens if not hundreds of thousands. And my friend, Mr. Dury, has drawn your attention to the fact that the herons and other water birds have been destroyed by thousands in the swamps of Florida.

Now, the *argument* sought to be sustained by this startling array of figures is, that we are in danger of allowing the extermination of species desirable to man on account of their song, or economically valuable to the agriculturist as insect destroyers; and the poetical quotations and crude generalizations which are invoked to excite our sympathies are such as relate to these species—*i. e.*, song-birds. In other words, while in the statistics cited, mainly gulls, terns, herons and "shore birds" appear prominently in the foreground, the *moral* is pointed *chiefly*, if not entirely at "song-birds"—so that the non-ornithological reader is extremely liable to the impression that the figures themselves apply to "song-birds" as much as to any others, and to have his sympathies aroused accordingly. But when informed that these are almost wholly marine species—gulls, terns and "shore birds"—the scavengers of the ocean and ornithological tramps, so to speak, most of them being migrants, whose home is far beyond the confines of civilization; whose only "song" is a mere "screech or squawk," anything but musical to human ears, and which are not in any degree beneficial to man except for their feathers—*these facts considered*, does it *really* seem so bad to make merchandise of their plumage for ornamental purposes?

As for the destruction of thousands of herons and other water-birds in the swamps of Florida and Texas, this affects neither song-birds nor civilization, since their notes are no more pleasing than those of the gulls and terns; and they are doomed to extirpation

regardless of milliners and fashion whenever civilization drains and cultivates their nesting and feeding places. If we look at this part of the subject in an *economic* light, we shall see that these birds, chiefly herons, are the natural enemies of fish, so that their destruction, in the long run, directly favors the increase of food for man. Furthermore, their habitat is in districts entirely uninhabitable to the human species, and they would forever remain unknown to man but for the ornithologist, the sportsman and the milliner.

Now, leaving the gulls, terns, shore-birds, grebes and herons for the present, let us examine some of the figures of our pessimistic friends which *do* apply to *song*-birds and their use for millinery purposes. Here we are struck at once with the absence of definite figures, and in their place find such generalizations as "many song-birds" and "war of extermination" on catbirds, robins and thrushes.

One New York taxidermist is quoted as having thirty thousand skins of "crows, crow blackbirds, red winged blackbirds and snow-buntings." The first three species of disputed or doubtful benefit to man on account of their omnivorous diet, and with no song worth mentioning, excepting the clear whistle of the red-winged blackbird; while the fourth species is a far Northern sparrow, a winter visitor only in the United States, irregularly distributed, subsisting chiefly on seeds, and with no more song while with us than the European sparrows in our streets.

Again, the extent of territory from which this thirty thousand skins were derived is not mentioned—a very important item, as I shall hope to show later.

The most definite observations as to the use of song-birds are those by Mr. F. M. Chapman, as the result of *two* afternoon walks in the "shopping" districts of New York. He gives a list of forty species observed of which fifteen only can, by the most liberal classification, be denominated song-birds, including two sparrows, which are only winter visitors in the United States. The aggregate number of individuals belonging to this lot is stated at 174, which may be classified as follows: Song-birds and useful species, 30; useful but not song-birds, 38; birds of doubtful and negative value, 106. Amongst those classed as of negative value are some really objectionable as destroyers of useful species, namely, the shrikes and jays. The others in the negative list are chiefly terns, gulls, grebes and shore birds.

To this I may add my own observation, made yesterday, of a large wholesale milliner's stock in this city. Taking a dozen or two of boxes at random from the stock, here is the list: 24 tropical blackbirds (South American); 24 tropical orioles; 20 tropical king-fishers—habitat, Mexican border to Brazil; 12 troupials (South American); 6 large and very wicked-looking jays (not recognized as North American); 6 pigeons, of a species whose habitat is West Indies, Central an South American and Florida, hence locality uncertain, 12 white-shouldered blackbirds, *not* North American; 24 maroon tanagers—Brazilian; 6 heads of California quail; 1 red-shouldered blackbird; total, 137 skins, of which seven only are undoubtedly North American, and none of this seven song-birds.

I should not omit to mention the statement of my friend Mr. Dury, as to seeing "bluebirds by the bushel" in a taxidermist's stock in New Jersey. Now, Mr. D. does not say *how many* bushels, but we may suppose *three* bushels at one hundred skins to the bushel to be a pretty fair stock. Three hundred bluebirds killed in the State of New Jersey, with an area of 8,320 square miles, is equal to one to about every thirty square miles, and we are not assured that they were taken all in one season either. Does any one suppose this one blue-bird to thirty square miles would create a noticeable gap in the fauna? But how small are these figures, and how scanty the facts, as compared with those relating to the gull, terns, herons, &c. To be sure we find mentioned by Mr. Allen, and quoted by your committee, "the million of rail and bobolinks" killed in a single season near Philadelphia. These, however, have been destroyed annually for the benefit of Philadelphia and New York epicures for many years before bird wearing came into fashion, so it is out of the question to charge their destruction to "bird-wearing ladies." And even with this formidable rate of destruction we do not see that either species has become extinct or even noticeably diminished in numbers. But suppose we consider, for the sake of argument, that birds are destroyed equally for millinery purposes—songsters and beneficial species along with those of negative value economically considered. To what extent are bird-wearers responsible for their destruction?

Prominent amongst the statements made in Mr. J. A. Allen's paper, and quoted by your committee in the use of birds for millinery purposes, is the assertion that ten million American women are of a "bird-wearing age and proclivities." Some might con-

sider this an exaggeration, which it probably is, but for the sake of a basis we will admit it to be true. Mr. Allen further estimates, allowing for the "making over" necessities of the economically-disposed ladies, that five million birds per year will be required to satisfy this demand.

Now, what effect practically, will this have on the bird fauna of America, for as two-thirds or more of the birds of any one North American locality are migrants, and many of them pass from South to North America, and *vice versa*, we must estimate the effect on the continent at large, as we do not limit the bird-wearing ladies to any one locality. Moreover, the ornithologist who attempts to identify the contents of boxes of bird skins in our millinery establishments will find the vast majority of exotic forms, as I have already noted. The ultimate influence of the destruction of birds then must be estimated by the number of birds in the whole country. Now, unfortunately for our purposes we have no reliable census of American birds, as applied to individuals, but, following the example of Mr. Allen, we may *estimate* that the 15,000,000 square miles, comprised in North and South America and the West India Islands, will average at least two hundred birds to the square mile (and I think my ornithological friends that are present will agree with me that this is an exceedingly moderate estimate).

According to our estimate, then, we would have a bird population in the Americas of 3,000,000,000—(that this is not an excessive estimate is evidenced by the fact that Alexander Wilson computed the number of pigeons alone in a single flight at over 2,000,000,000)—or 1,500,000,000 pairs. Now, another very moderate estimate would allow at least two birds *per annum* to each pair for natural increase; so that 3,000,000,000 birds must be destroyed annually, by all causes, in order that the bird fauna shall remain at its present proportions; in other words, until that number are destroyed there will be no decrease in numbers. Now, the proportion destroyed for millinery purposes taken at Mr. Allen's estimate of 5,000,000 and allowing another 5,000,000 for South America, Canada, Mexico and the West Indies, would be as 10 is to 3,000, or as 1 to 300; the other 299 meeting their death from other causes. In other words a mortality rate of 3 1-3 per 1,000, while a rate of 20 to 25 per 1,000 in the human species excites no comment whatever.

The actual rate in the birds is manifestly much less than that above stated, since a section of the country with only 200 birds to

the square mile would probably be the rare exception rather than a frequent occurrence.

Be it noted, furthermore, that the constant demand for novelty, to which fashions are due, prohibits a continuance of even this low mortality rate for many years in succession.

Figures aside, however, it is a self-evident fact that all species of animals and plants require checks to their maximum rate of increase. (The human population of the United States, at the ordinary rate of increase, would number four to every square yard of the earth's surface in less than seven hundred years).*

Now, of the many natural checks upon the increase of birds, some are removed by civilization, others are increased.

Then again, there is even a higher factor that governs the increase or decrease of different species—which is unknown to us except by its effects, namely, the inherent capacity of the species itself to increase.

As an instance of the disappearance of a species without known cause, we have the case of own parroquet, a bird abundant in large flocks, throughout the Ohio Valley in the first quarter of the century, noted by Audubon in 1831, as rapidly diminishing in nnmbers; by Kirtland and others, in 1838, as only met with irregularly, and as straggling flocks. While we have no recorded date of their appearance in this State, between 1840 and 1862, when a single flock of stragglers were noted in Columbus.

Throughout their range we have the same accounts of constantly diminishing numbers, as we had before the days of bird-wearers, taxidermists, pot hunters, or ornithological collectors in the West. In accordance with this capacity some species are to-day increasing, while others are dying out, much as they did in former geologic times before the human biped made his appearance; and man to-day is only one check upon species, in Nature's vast game of chess; and not by any means so important a one as he is apt to imagine.

To sum up, then, the practical influence of bird-wearing upon our fauna, we may note:

First—That the North American birds used in greatest numbers are gulls, terns, herons, and others, *not* song-birds, nor species beneficial to the agriculturist.

Second—That our most desirable and familiar song birds, such as thrushes, wrens, greenlets and finches, are in limited demand, on account of their generally plain colors.

* Darwin, "Descent of Man," p. 120.

Third—That of the briliantly plumaged birds, a vast majority come from South America, and other foreign countries.

Fourth—That probably enough of shrikes, jays, crows and other predatory species are destroyed to more than compensate for the few song birds actually killed by man for all purposes.

Fifth—If all were song-birds and equally beneficial the reduction in numbers from this cause would be inappreciable in its effects on the fauna of the country at large.

Coming down to the consideration of the birds of our own locality and surrounding territory, Mr. Dury has given us a very interesting reference to the abundance of the wild pigeon in this region twenty-five years ago, and has noted their scarcity at the present day. The last great flignt of these birds that I remember here was in the fall of 1865, when the air was darkened with them for the greater part of two days.

Now, *their* disappearance is certainly not due to the demands of the milliners; and while the pot-hunter and the "bad small boy with a gun" have probably destroyed their share, much more influential factors in causing their disappearance in my opinion have been the demands of agriculture and commerce, causing the destruction of the mastbearing forests where they fed and nested. The same factors account mainly for the disappearance of our larger game and water birds—*i. e.*, clearing forests, draining swamps and so on.

And we might as well attempt to stay the progress of Old Father Time himself as to check civilization in order to save these birds. "But, it may be asked, must our civilization eventually cause a birdless country?" Not by any means; on the contrary, we shall find if we study the comparative abundance of birds *in general*, in most civilized sections of our country, that birds are probably more numerous, both in species and in individuals, than they were in the earlier days of its settlement. On this point I will take the liberty of quoting from an article by myself in the Journal of this society for 1879:

"During the past forty years several important changes have taken place in our local bird fauna. As in all thickly populated districts the wild turkey and prairie chicken have been exterminated; the parroquet, which formerly occurred in abundance throughout the Mississippi and Ohio Valleys has at present a much less extensive range, being mainly confined to the Gulf States; the beautiful swallow-tailed kite (*Elanoides forficatus*) has apparently

ceased to visit us, and our two largest woodpeckers (*Campephilus principalis* and *Hylotomus pileatus*) have disappeared along with the dense forests that were their favorite resorts. The seventh extirpated species is the raven, which is said to have been a common resident of this section in former times.

"To offset these losses we have the cowbird and the black-throated bunting in abundance, both of which were considered of doubtful occurrence in Ohio forty years ago; the Kentucky warbler, loggerhead shrike and lark finch are also inferred to have made their appearance within the same period, as they were omitted entirely from Dr. Kirtland's list; and the cerulean warbler, now a common summer resident throughout the State, was observed by him in one instance only, a fact strongly suggestive of its comparative rarity at that time. Within the present decade two European species, the house-sparrow and the sky-lark, have also been added to our fauna, the former of which seems likely to exceed in numbers any one of our native species, unless its extraordinary increase should be checked by natural or artificial means—a consummation devoutly to be wished."

"The foregoing are doubtless but a portion of the changes in the Avian-fauna of this locality within the period mentioned, as many others, of which we have no definite record, have probably taken place; it is apparent, however, that the various conditions attendant upon civilization have resulted, directly or indirectly, in the extirpation of several of our larger species; while, on the other hand, there has been a decided increase both in species and in individuals, among the smaller birds. And finally, in these various changes that have occurred in our Avian-fauna, we have an excellent illustration of the workings of that universal law of nature, in accordance with which the living things of a country or district become adjusted to their surroundings; protection from enemies and an increased food supply, resulting in a greater abundance of some forms, while extirmination is the fate of others whose habits or constitutions will not admit of the modification necessary to adapt them to new conditions."

Instances might be multiplied to show that civilization and cultivation of the soil favor the increase of small birds, and the reasons for this are obviously: First—That the clearing away of forests and introduction of new seed and fruit bearing plants, which are also the food of a host of insects, directly favors the increase of food for small birds, both seed and grain eaters and insect feeders.

Secondly—The destruction of the larger birds of prey, and predaceous mammals, such as weasels, wildcats and other bird enemies likewise operates to permit the increase of small birds. Thirdly—The providing of better protected nestingplaces, such as barns, bridges, cornices, bird-boxes and so on, insures a lessened mortality among many small birds, e. g., wrens, bluebirds swallows, &c., in their immature state."

Another phase of our subject which has been lightly or not at all discussed by your committee, is the relation of ornithological collectors and students to the destruction of birds. Possibly, some members of the committee, like myself, have felt the reproval of a "guilty conscience," and were willing to let this part of the subject be touched as lightly as possible. But John Burroughs,* one of our most beautiful writers on birds, of the purely sentimental class, has attacked "the collector" and "ornithologist" with quite as much *vim* and savage denunciation as the members of your committee have bestowed upon the pot-hunter, the small boy and the milliner —and perhaps with quite as much reason, from *his* standpoint. But *fact* is of more value than *sentiment* in scientific matters. Suppose, therefore, we look at some of the *facts* in connection with this part of the subject. In round numbers two-thirds of our birds in this locality are migratory, and consequently are shot by collectors over a wide extent of territory.

To illustrate this problem then we will cite a few figures, as they apply to the neighboring States of Ohio, Indiana and Kentucky. These States, with an aggregate area of 112,000 square miles, contain forty-two registered collectors, according to the naturalist's directory. Now, allowing an increase of 100 skins per year to each collection, (and this is certainly a very liberal average) we have 4,200 birds taken affecting 112,000 square miles; in other words, one bird to each twenty-seven square miles. Does any one suppose this will make a noticeable diminution in their numbers? And even here we leave out of account the small birds *saved* by the removal of shrikes, jays, hawks, and other rapacious birds.

If these things *were* considered the "collector" would perhaps even have a small balance in his favor, aside from the obvious fact that it is to the "collector" and "ornithologist" that "sentiment" owes its knowledge of our birds; but for him hardly one in ten of our species would ever be known to exist, and the songs, habits,

* Century Magazine for 1885.

structure and other peculiarities of hundreds of species would remain forever unheard and undescribed by man.

Even the destruction of birds by the much execrated small bad boy with a cheap shotgun is not without its mitigating features. For example, Spencer F. Baird, the present head of the Smithsonian Institute and U. S. National Museum, was, in Audubon's time, one of these "small boys" possibly as wicked-appearing as any. And even of the illustrious Audubon himself, we read, in his boyhood days, that "supplied with a haversack of provisions, he made frequent excursions into the country, and usually returned loaded with objects of natural history, birds' nests, birds' eggs," and so on. Now, it is not to be supposed that all amateur boy ornithologists will develop into Audubons, Bairds or Allens or Coues or Ridgways and yet no one who considers the subject in its broader bearings can ignore the fact that the concentrating of the mind upon so attractive and instructive a subject as the study of birds, must have, in the long run, an elevating and refining tendency; and in any event boys might be in much worse mischief, both bodily and mentally.

We may dismiss the small boy then, with the remark that he has as much right to the gratification of his developing taste for ornithology as the more pretentious collector who may have the means and inclination to employ a dozen or two small boys in the interest of his collection.

As regards the purely humanitarian view of the subject, if we are going to condemn the wearers, or collectors of birds on the ground of discouraging "cruelty to animals," we must also, to be consistent, oppose the *scalding alive* of myriads of embryo winged creatures, in order that humanity may wear silks and ribbons, and object to sealskin garments, because the poor, innocent animals are butchered by thousands on Alaskan Islands with no chance for resistance or escape.

But our subject is too large and our space too limited to permit us to even touch upon all its bearings.

Now, ladies and gentlemen, I would not have you suppose, for a moment, that I am an enemy to our birds; on the contrary, some of the pleasantest hours of my life have been spent in their company.

Neither do I believe in the extravagant statement quoted by one member of your committee, that the "United States are going raight to the desert condition of a country without song-birds."

Such exaggerations and inferences as that defeat their own purpose; and to refute them, it is sufficient, in my opinion, to cite the practical fact that no song-bird is known to have become extinct, or even materially lessened in numbers, over any wide extent of our country, and where they *have* become diminished in limited localities, it has been chiefly due to the introduction by a lot of well-meaning but misguided sentimentalists and ornithological cranks, so to speak, of a foreign species (the European sparrow), which pre-empts their nesting places, eats up their food, and otherwise increases at their expense, so that they are forced to seek a home elsewhere.

Another cause of decrease in some localities—and a *preventable* one—is the removal of their favorite abiding-places, such as thickets and shrubbery. Where this is not done there is no reason—aside, perhaps, from the European sparrow—why our suburbs and country places generally should not possess more song-birds than they ever did in the early days of the country's settlement.

While, therefore, I am in favor of the increase of desirable birds, of the utmost dissemination of knowledge respecting all birds, of the formation of Audubon Societies, if you please, and of the popularizing of ornithology in general, I do not think we gain anything in a scientific or practical sense by distorting, misstating or suppressing facts, exaggerating figures, or by denouncing the well-established right of man to use all natural objects for the furtherance of his necessities, his convenience, or his pleasures.

In concluding, ladies and gentlemen, let me say to you that my remarks this evening are merely a few random notes and comments upon a subject of vast extent. And if I have succeeded in directing your thoughts to a few of its important relations to humanity and the rest of animated nature, I shall have accomplished my present purpose.

FIFTH PAPER.

By Mr. Chas. Dury.

(Read June 16, 1886).

Ladies and Gentlemen—When requested by the Lecture Committee of this society to prepare a paper on the destruction of native birds, I did not understand that the object was simply to speak of song-birds, as popularly restricted, but that all birds were to be considered that merit our protection (and what birds do not?) Some of the statistics presented were those offered by the most eminent observers and ornithologists of the East. And far from their being exaggerations, the fact is the truth has not been half told. The absence of sea birds from their former haunts is sooner noticed than the absence of forest birds, and statistics are easier to obtain. Though, in regard to other birds, they are neither wanting nor unreliable. In the paper referred to above I might have brought forward many more facts and statistics had I supposed any one would have disputed the point or questioned the advisability of doing everything that could be done either by the force of public opinion or legislation to protect our beautiful and persecuted birds. The report comes from all parts of the country of the decrease in the number of native birds. Mr. Allen writes me:

"We are receiving letters from everywhere, deploring the decrease of small birds, showing their decrease is a fact so palpable as to attract the attention of very many of our correspondents living at widely separated localities." I should be loth to believe that these persons, many of them eminent in science, have either exaggerated or falsified. The effects of such a paper as the one read at the last regular meeting of the society must be most pernicious. A person at the meeting was heard to remark: "We need not feel so badly after all about it." "A wink is as good as a nod to a blind horse." Create a market for our birds and relax the frown of public opinion and they are gone. The protectors of game and other birds have an almost impossible task to perform, and with protective laws (whose language can not be misunderstood) on the statute books of nearly every State and Territory in the Union, the numbers of our birds are found growing less each year.

Dr. Langdon in the paper referred to estimates the number of birds in the Western Continent, with fifteen million miles of area,

at two hundred birds to the square mile. Or, to bring it more within our comprehension, the two million square miles of area in the United States, with its two hundred birds to the square mile, and we have four hundred millions as the total number of birds in the United States. He does not say if this guess is made up from the migratory season, or the average residents during the year. I presume, however, it is the latter, and according to this method of computation he figures out that birds double their numbers by natural increase each year—a stupendous counting of chickens before they are hatched. As there are absolutely no statistics on this subject, this is in the nature of new information to ornithologists. There is a large extent of country in the United States almost destitute of birds.

During the winter the great plains extending from Texas up to the British Possessions are destitute of bird life, and even in summer birds are very few and far between. I have traveled all day over the desert country of New Mexico without seeing a bird, and it is only when one comes near water that birds begin to appear. In traveling through the Rocky Mountains, and also through the mountains of West Virginia in the summer, I was astonished at the small number of resident birds. Dr. Freeman and myself observed the same condition in the dense pine forests of Michigan, and that, too, in summer, when birds should have been most numerous. Back from the Nipegon River the fishing parties of the Cuvier Club report the country an avian desert, as I also found other parts of Canada back from the St. Lawrence. The vicinity of this city is one of the most favored localities in the land for birds, and by comparing local lists it will be seen that there are but few places comparable with it. I mention the above facts to show how impossible it is to even guess approximately at the number of birds in the area given. Dr. Langdon deprecates the want of facts and reliable statistics in the paper read by your committee and then proceeds to reason from a theory based on such guess work as this. Nor does he make due allowance for the tremendous destruction from natural causes which threaten the lives of birds at every stage of their existence. Elliott says: "Birds that return in spring are not more numerous than those which came the preceding spring; whereas, those that went back in autumn were two or three times as numerous." Dr. Langdon states that man is but one of nature's checks to the undue increase of birds.

Man is an unnatural additional exterminating check. J. A. Allen says: "Whatever man does to destroy birds is purely a drain upon the supply of bird life, added to the natural checks by which nature keeps the balance even, and is disturbing and destructive just in proportion to the extent to which it is carried, and for which nature has no means of compensation."

Against the killing of food birds under proper restrictions, or killing birds for any scientific or educational purposes, I have nothing to say, but to shoot a beautiful and harmless egret, that the few plumes that grow on its back may be used to make a grotesque hat or bonnet look still more grotesque is certainly a very bad economic proceeding, to say the least. If the idler who shoots for food the robins, thrushes and other song birds, as is largely done in some of the Southern States, would devote the price of the ammunition and the time it takes to shoot them to procuring some other kind of food he would quicker stock his larder.

If the growers of small fruits are not willing to compensate the birds for the benefits they confer on him in the destruction of injurious insects by giving some fruit, then he has a right to shoot them or drive them away. When a lot of cedar birds or robins come into one of my trees of choice cherries the way they gobble up cherries makes me tired, but it would be very bad policy to shoot them for it. As the old English farmer said. "Surely I can well afford to give a penny's worth of fruit for a shilling's worth of song."

Dr. Langdon says that any effort of man would not make any appreciable difference in the numbers of our song-birds, and that if this Government would appropriate a million of dollars to exterminate them it would make no difference in their numbers. This is a most extraordinary statement. Let us see what man's ability as an exterminator is.

Perhaps the earliest job of bird extermination of which there is any evidence was the destruction of *Æpiornis maximus*. While the natives of Madagascar assert that a few of these gigantic birds remain in some of the most secluded parts of the island, yet the probability is that they are totally exterminated, and without doubt by the hand of man, as the famous French traveler, Alfonse Grandidier, emphatically assures us.

The Moas of New Zealand were exterminated by man at a comparatively recent period. The "Dodo" (*Didus ineptus*), the great pigeon of the Mauritius, became extinct about 1693, killed

by man and destroyed by the dogs and hogs which the Dutch had introduced on the island in 1644.

The Capercaili became extinct in Scotland, but has been re-introduced and an effort is being made to protect and increase them.

The great Auk (*Alca impennis*), the celebrated "wingless bird," as it was called, was the next. A bird famous because of its tragic fate. It bred numerously on Newfoundland and the Funk Island during the last century. In 1844 the last survivors of the last colony in Iceland were killed. Now its skin and bones are regarded as the most precious treasures of the museums. Mr. Robert L. Stuart bought one for $625 and presented it to the museum in New York. These birds were unable to fly, hence the destroyers made short work of them.

If we refer to the animals, man's reputation as an exterminator will not suffer either, for one of the most familiar instances is the American Bison, that ranged the great plains of the West for untold ages, hunted by the Indians, who used its flesh for food and its skin for shelter, without any great dimunition in its numbers. The white man came upon the scene and slaughter was the order of the day. The grand but harmless animal is gone; its snow-white bones tell the story; a disgrace to American civilization. I now propose to show how man is decimating certain species of birds and has practically exterminated them over given areas. The most startling case is that of the wild pigeon, mentioned before by one of your committee. Dr. Langdon says this bird's destruction is due to the clearing the country of mast bearing trees rather than destruction by man. Undoubtedly man destroyed the trees, but this is not the principal cause, as only a portion of the mast bearing trees are destroyed, and any failure of mast simply caused the pigeons to move to a more favored locality. A flight of a few hundred of miles is nothing to such a bird. The grain that grows in the fields cleared of mast bearing trees compensates for the mast destroyed. In the Southern States the bird fed largely on rice. More rice grows in the Carolinas to-day than in the time of the wild pigeon. Along the Nipegon River, that comes down into Lake Superior from the North, the pigeons formerly came to feed on the berries that grow there. The berries grow there just as abundantly now, but the pigeons do not come to feed on them. In regard to the almost incredible numbers of the pigeon, it is interesting to trace their gradual diminution from the time of Wilson

and Audubon to the present day. D. G Elliott, in speaking of the birds' arrival at the roost, says:

"The arrival of this great host is an impressive sight. Long before their crowded ranks appear their approach is heralded by a sound resembling the rising of a gale of wind, increasing in loudness until they hurl themselves into their chosen nightly abode, when the din caused by the flapping of myriads of wings, the struggle for a place on the trees, the constant change of position and the crashing of over-loaded branches, is so completely overpowering that not only the human voice cannot be heard, but even the discharge of a gun would pass unnoticed. At one time pigeon roosts were not uncommon in the United States, but they are gradually disappearing, for the wild pigeon, like all other game, from lack of wise and requisite protection in the United States is being brought slowly, but surely, to its final extermination."

Colonel Harris, President of the Cuvier Club, with Mr. Benj. Robinson, has fished at Kelly's Island, Lake Erie, every spring for many years. Last April while there they did not see a robin, bluebird or thrush during their stay on the island, where they formerly saw many. In cruising around fishing, and particularly on the shoals where they caught their minnows for bait in former years, they saw flocks of gulls and terns, and particularly were terns very numerous, flying in flocks of hundreds, yet this season two or three were the most they saw together. They were informed by residents that there had not been more shooting than usual, but the birds had been killed before they got there. Mr. H. C. Culbertson, however, informs me that the scarcity of song birds on Kelly's Island is due to the residents, who turn out at the time the grapes ripen and shoot these birds, imagining they eat some of the grapes—by killing them for several years, the regular migrants become exterminated, and it is only by fortuitous circumstances that any birds get to the island. Here is an instance where man exterminates the birds over a given area; apply the same methods to a larger area and you would have the same results.

In 1884, Mr. Warner, a bird dealer of New Orleans, shipped over ten thousand nonpareils to different points, mostly to Europe. In 1885 he was only able to obtain four thousand for shipment, and this season (1886) he had an order from a dealer of New York for five hundred, and all he could furnish him was two hundred, so great was the scarcity of birds, and the consequent utter failure of his bird catchers to secure them.

In 1885 Mr. Klepper, in talking to the shippers of Cuban parrots, asked them what causd them to be so late in getting into port with their birds, and why the prices had gone from twenty-one dollars to thirty-three dollars per dozen. They informed him that the cause of delay and the higher price was due to extermininiation of the birds in their old haunts, and that they were obliged to go many miles into the interior to find any, and in speaking of the destruction of the mocking birds in the South he said: "When at New Orleans last season I went out to a suburb where I used to go to see and listen to the mocking bird. To my dismay when I got there I did not see a bird. On inquiring I was informed that the bird catchers had cleaned them out in that locality." Mr. Klepper also said of the cardinal grosbeak: "Formerly I used to receive these birds in large lots of from fifty to one hundred, but now I never see over two or three in a lot, so few, in fact, it does not pay to ship them. In the case of the nonpareils above mentioned, nearly all were males caught with a call bird when the birds were full of song and fight, just previous to the breeding season. Does any reasonable person pretend to say that 10,000 male nonpareils handled at such a time by one person, (to say nothing of the thousands handled by other dealers), would make no appreciable difference in the numbers of this bird? Mr. Alex Starbuck, of this city, was in Los Angeles, Cal., last winter, and while there he visited a taxdermist, Mr. Whately, who showed him an order he was trying to fill for a lady, (one of the angels of the place I presume.) This order was for enough small owl heads to trim a dress, with a row up each side and a row around the bottom. It took over sixty to do the job, Whately had got stuck, as the supply of owls in that locality had given out.

I presume when Flora McFlimsey saw this unique dress she would mentally resolve, if there were owls enough left, she would beat that dress or bankrupt herself. I have had orders for owl's heads to be worn on bonnets. I sold a lady an owl's head for her bonnet, she paid me the price of the entire bird for its head and I had the body left to sell to somebody else. When fashion gets after the poor owls may the Lord help them.

Mr. Starbuck speaks of the great scarcity of small birds through the South (in localities visited by him) as compared with former years, he says since guns have become so cheap and easy to obtain, the birds have rapidly lessened in numbers, and the Superintendent of the Sportsman's Shot works of this city informed him

that more shot was shipped to Kentucky by them, than to any other State, for nearly every man and boy has a gun, and they bang away at every living creature.

Mr. Starbuck also mentions the Pacific coast, and speaks of the Chinese as being the most skillful bird-trappers in the world. He says they catch and eat everything in the shape of a bird. In making inquiries of taxidermists and bird collectors as to the cause of the scarcity and great decrease of the birds there, they informed him it was due to the enormous numbers killed by sportsmen, collectors of birds and their eggs, and shooters generally, for California has supplied the world with the peculiar fauna of the Pacific slope.

The migration of birds is not thoroughly understood, but enough is known to show that the migration movement is not a pell-mell headlong rush without an object, except to change location; but an orderly, systematic, intelligent movement actuated by that grandest and most wonderful incentive, the perpetuation of the species. That birds come back to the same spot where they reared their broods the year before, bringing their young with them, is well proven. "Migrating birds have an inherited talent for geography," as Weissmann happily expresses it. Peculiarly marked birds run the gauntlet of their innumerable enemies and come back several years in succession to certain spots. Thus we see that birds that migrate up the Ohio Valley do not mingle with those that pass up the Upper Mississippi, except at the point in the South where they pass the winter. Consequently if the fittest survive the many checks to their increase and return to their nesting ground to be there persistently persecuted and killed, then that locality will soon become destitute of bird life. That man, by friendly advances and protection, can increase the number of birds in a locality can be easily shown. Twenty-seven years ago when my father moved to our present home place in Avondale, there was but one stunted tree on the place, it being a meadow. The only bird I saw there on my first visit was a meadow lark (which I foolishly shot, and got a terrible raking from the old gentleman for doing it). The place was soon thickly planted with trees and the birds began to appear, until I have recorded up to June 1, 1886, 114 species, ranging from one to many individuals of each species. If it is in the power of man to so largely increase the numbers of birds in a locality, why could he not decrease them?

Dr. Langdon speaks of having examined the stock of birds of a wholesale millinery house in this city and having failed to find any song birds in them. I called on perhaps the largest dealer in this line of goods in this city, a gentleman who has had thirty years' experience in the business, and perhaps knows more about the trade than any other, and he told me as follows: "This is the wrong season of the year to find many birds in stock.

"In the better grades of goods you will not find so many native birds. It is in the cheaper stocks that they come, because they are put up in immense lots and can be sold cheap. While we handle the higher priced goods, yet we have had thousands of native birds and feathers of all kinds, such as robins, meadow larks, jays, &c. Egret plumes are very high and scarce, as the birds are nearly exterminated and we can't get them. Paradise birds are very high and becoming scarce. I have seen them sell for from two to three dollars each, and now they bring eight to ten dollars. The wing of one species of dove suitable for dyeing has gone up from six dollars per gross to sixteen dollars per gross. The dealers around New York collect all the time, for if a kind goes out of fashion they lay them away until they are wanted again."

A lady showed me a barn-swallow she had bought for her hat, and for which she paid fifteen cents, and the store where she bought it had boxes full of them—"Your choice for fifteen cents each." They said they were selling them out cheap, as they were overstocked. I went up to this store to count these birds (fearing lest this might be set down also as an exaggeration). They told me that it was out of season and their stock was packed away. In regard to the New Jersey dealer before mentioned, I did not count his stock of native bluebirds. Dr. Langdon, however, supplies me with their number from his never-failing stock of figures; it was three hundred, or one to thirty square miles. Now, for fear of exaggerating, I presume he fails to speak of the many other dealers and collectors in New Jersey of whose stock this one was only a sample. Mr. Allen says in a letter, before referred to: "Judging by what we see in the East in the cities and towns generally, two-thirds of the birds in point of numbers, used for hats, are our native song-birds."

If the efforts of man are of no importance in the destruction of birds, as Dr. Langdon would have us believe, what an immense amount of valuable time and thought has been wasted in legislation

in passing laws for the protection of birds, not only in this country but also in Europe. The law is so severe in some parts of Germany that for the second offense in destroying a nightingale the punishment is imprisonment in the penitentiary, the punishment for the first offense being a heavy fine; while to keep a nightingale in a cage one has to pay a license.

France, better than any other country, shows the result of man's destruction. In traveling from Mt. Cenis to Paris I did not see any birds except a few sparrows, and even these were scarce and shy, and in the parks and other places where birds are protected, the only wild birds observed were a few wood pigeon and sparrows. In Italy, outside of the gardens and parks, birds were very scarce, caused by the enormous destruction carried on by the inhabitants, who eat up everything from a least titmouse to a hawk.

Skylarks are regarded as a great dainty in Europe. Statistics inform us that over five millions were brought annually into Leipzic, and into the little town of Dieppe, France, the official returns state that during the winter of 1867-68 one million and a quarter were taken. I suppose Dr. Langdon, by his methods of multiplication, would figure out that the destruction of this vast number of birds would make no appreciable difference in the quantity in the vicinity of these cities.

The paper under consideration, in endeavoring to prove that birds are becoming more numerous in this locality, mentions several species in support of the theory, prominently the Cærulian wrabler and the quail. He states that the Cærulian warbler was but once observed by Dr. Kirtland, therefore it was *not* here at that time. He further stated that it is now the commonest warbler we have This warbler is a forest bird, and frequents the tops of forest trees, and moreover, is very small, so that Dr, Kirtland may have overlooked it (as I did myself for several years.) It being essentially a forest bird, the clearing of forests would rather diminish than increase them. I found them common one season in Clermont County, but not nearly so abundant since. In Avondale it has always been an uncommon bird, and not nearly as abundant as several others of the *Sylvicolidæ*. This last spring (1886) I failed to either see or hear a single one.

Dr. Kirtland speaks of this species in 1838-1841, and again in 1852, so he must have seen it oftener than the single time, as

stated. I should therefore consider it extremely doubtful if it was not as abundant fifty years ago as it is now.

Another bird mentioned as increasing is the quail, though in the newspaper report published all mention of this species is eliminated. Dr. Langdon quotes from "Nests and Eggs of Ohio Birds" to show that under the tender mercies of the pot-hunter, market shooter, quail trapper and other concomitants of civilization, the quails are becoming more numerous, when such is notoriously not the fact.

A partial civilization is undoubtedly favorable to the increase of quails. Alternate fields and woods, with dense thickets for cover, are the favorite haunts of these birds, but a high state of scientific farming is fatal to them, as was forcibly brought to my notice. About twelve years ago I hunted quails northeast of Glendale, and though we found many coveys, we got but few birds, as they flew into the dense thickets and briers, where they were safe at least from our guns. Three years ago I went over the same ground and found the farmers had improved their methods of farming. and cleaned up the briers and thickets, while the hard winters, shooters and vermin had cleaned out the quails, for we failed to find any. In the last twenty years the price of quails has more than doubled.

I have interviewed some of our most experienced sportsmen, and they all say quails in this State are becoming very much scarcer. Mr. N. A. Crawford, a farmer near New Baltimore, Ohio, informs me that he had only seen one or two quails on his farm in the last three years, whereas in former years he had several large flocks on the same ground. These facts do not point to the increase of quails, as Dr. Langdon endeavored to show.

In regard to the cowbird, black-throated bunting, and the other species mentioned as being absent from this locality forty years ago, because they were omitted from a local list is an inference drawn from very slender evidence.

I do not think anyone would urge the destruction of their food, as the cause of the rapid decrease in the numbers of the pinnated grouse. Where I hunted them at Odin, Ill., some years ago, I saw many, but they are now nearly, if not quite extinct, in that locality.

In 1872, I hunted the same bird at Kennekuk, Kan. I could easily bag as many as I could carry, and saw flocks numbering

hundreds of individuals. Now, a relative recently from there, tells me the prairie hens are nearly all gone from that locality.

The statement that our most desirable and familiar song-birds are not in demand on account of their plain colors is a distortion of the facts in the case. I was once offered an order at good prices either in cash or in exchange for South American birds, for as many scarlet tanagers, Baltimore orioles, yellow-breasted chats, indigo birds, bluebirds, cardinal grosbeaks, wood-thrushes, robins, brown thrashers and meadow-larks, all of which are our most valuable and familiar songsters, and nearly all the brightest colored of our birds. In fact, the letter stated that almost anything could be used in almost unlimited quantities. It is a mistake to suppose that brilliant color is the only desideratum in birds for hat decoration, for the plumage of the peafowl (one of the most brilliantly colored birds in the world) is not used as much as some of our more plain coated songsters.

In regard to the omnipresent small bad boy we must agree with Dr. Langdon, that he *might* be in worse mischief than robbing bird's nests and stoning birds (a study of ornithology undoubtedly has an elevating and refining influence, and was never complained of by your committee), and we would not entirely suppress him (in an ornithological sense) either for fear of depriving the country of some Baird, Audubon, Allen or Ridgway. Yet it might be difficult to convince our surburban residents, who love and protect birds, that the plundering young urchin's gratification in developing his taste for ornithology with rocks and pea-shooters is in any way conductive to science.

Mr. H. Wilson Brown, who told me recently how some robins had attempted for two years in succession to rear broods in the shade trees in front of his house, but each time the boys had destroyed the nests, and that one disciple of the pea-shooter was seen in the neighborhood with thirty-five fresh birds eggs in his possession, as the result of one morning's foray; or the Rev. Mr. Rishell, who brought me a mangled wood thrush, shot from her brood near his door by one of the above mentioned disciples, who was thirsting after ornithological knowledge—these gentlemen, I fear, would consider this more partaking of cussedness than science.

There are about twenty-five persons, mostly boys, who collect birds' eggs in this vicinity, and who systematically hunt for nests and eggs, and in most cases the sole object seems to be to get more

eggs than somebody else, just as boys collect buttons and postage stamps. These collections aggregate ten or twelve thousand eggs, perhaps one-half or two-thirds being from this immediate vicinity. I think also the egg collector is on the increase. I therefore conclude that the small boy is a formidable competitor with the domestic cat as a bird enemy in thickly settled suburbs.

The summary disposition of the "ornithological tramps," as this paper (which has so high a regard for scientific accuracy and such a poor opinion of sentiment) styles the egrets, herons, gulls, terns and shore birds of use for nothing but their feathers!—a direct waste by nature of so much raw material. I am glad most lovers of nature have enough sentiment in them to see other and far more important uses for these beautiful birds than a few feathers.

In conclusion, I would say, at the last meeting of the society I was asked if I had noticed any great diminution in the numbers of our small birds. I replied no, but my observation was confined to a place where birds are somewhat protected, in the woods. This spring I found but very few birds, but attributed it to seasonable influences. As my own observations had covered so small an extent in 1886, I have interviewed quite a number of persons interested in birds, and persons whom I knew to be accurate and competent observers. Their answers were, invariably, birds are much scarcer than they were some years ago.

Mr. Cliff Allen said that in Glendale, near the park, birds were, he thought, about as abundant as ever, but outside the village their numbers had decreased to a marked extent - particularly so were the red headed woodpeckers, which the boys had used as a target for their guns. Mr. W. A. Clark, President of the Wyoming Shooting Club, stated that in the towns where birds were protected they had not decreased, but in the country around he noticed their much diminished numbers.

SIXTH PAPER.

By Wm. Hubbell Fisher, Esq.

(Read June 16, 1886.)

Ladies and Gentlemen, fellow-members of this Society, we have assembled to discuss a very interesting subject, pregnant with influence for good or evil to the farmer, the horticulturist, the fashionable classes of our land, and to all who love and enjoy our birds and their melody of song.

Our first meeting held under the auspices of this Society, on evening of the 25th of May last, grew out of an appeal from the Audubon Society. This Society was begun in New York City in February of this year.

What is the object of this Society? Its purpose, as it states, is the protection of American birds, not used for food, from destruction, chiefly for mercantile purposes.

How came this Society to be? Because the leading ornithologists of America, in the American Ornithologists Union, discovered that an immense number of our native birds were every year destroyed. The majority of these birds thus killed were used to trim hats, muffs and dresses; sometimes the wings, but oftener the head and body.

Fellow-members, I intend to discuss this subject broadly, and to base what I have to say upon facts of science and upon such well known facts belonging to our nature, that shall, I trust, convince you that it is now desirable to create a public sentiment in favor of the protection of our birds.

Of what avail is any science? Certainly a science confers most benefit upon a commonwealth, just so far as it most contributes to the economies and substantial welfare of the people.

It will be observed that the question I discuss to-night does not include the birds used for food.

Organizations, like our Cuvier Club, are found in every large city, who contribute their money and use their influence to secure proper protective legislation for the preservation of the game of our country, and to prosecute the offenders of such laws.

So we can, as the Audubon Society does, well afford to leave the care of game birds in the hands of their organized protectors.

But, alas, the other birds have had but few to act for their

protection. On our Statute book there is a law making it unlawful to kill a certain few of them, but it is practically a dead letter.

Did you ever see a law enforced when nobody was interested in its enforcement?

PURPOSE OF THE AUDUBON SOCIETY.

To secure the protection of our birds by awakening a better sentiment, the Audubon Society, named after the greatest of American ornithologists, has been founded. The object sought to be accomplished by the Society are to prevent, as far as possible,—

(1.) The killing of any wild birds not used for food.

(2.) The taking or destroying of the eggs or nests of any wild birds.

(3.) The wearing of the feathers of wild birds. Ostrich feathers, whether from wild or tame birds, and those of domestic fowls are specially exempted.

How does the Audubon Society work? It says, "The remedy is to be found in a healthy public sentiment on the subject."

And when it uses the word sentiment, it does not mean a namby pamby idea, a dudish feeling, a sickly, foolish, æsthetic idea which scorns the useful, and glories in a sunflower badge.

Sentiment is a combination of science and heart; science points out the path, and the heart impels the individual to action.

Hence when our friend, Dr. Langdon, heads his remarks, Science versus Sentiment, he either gives a very low meaning to the word "sentiment," or puts science in a false position.

The idea of the Audubon Society is to create a principle of action founded upon intelligent public information and knowledge.

Obviously it could not afford to use clap trap arguments, or to distort the facts, as such a position would in the end destroy confidence in its movements and react with terrific force in its overthrow.

It is not to be supposed, therefore, that it would intentionally throw itself upon the public of 50,000,000 of people without at least believing that it had a deserving and necessary cause for action.

Moreover the source from which a movement springs assists us materially in determining whether the movement is founded upon right reason.

Who are the originators of this movement? They are powerful thinkers, men who have devoted their lives, some of them well advanced in age, to the study of birds, their habits, their haunts, their food, the causes of their destruction, and to their presence or absence in different localities.

The American Ornithological Union comprises a large number of the best ornithologists of the United States, and their committee fully and heartily endorses this movement.

So far as the foundation of the Society is concerned, therefore, we have a *prima facie* right to suppose that there is a good and sufficient cause for its beginning.

Dr. Langdon attempts to palliate the acts of the small bad boys in killing birds and robbing birds' nests of their eggs, and he even goes so far as to instance the youths of Professors Baird and Audubon as an excuse for the acts of these small bad boys.

If the small boys were as good as Audubon they would never have been mentioned by me. In my former remarks I stated that a lady from St. Louis mentioned that during last month, a boy about 10 years old living in an adjacent house in the suburbs of St. Louis, and who had a gun, was accustomed to get up early in the morning and shoot at every bird he could see.

I also instanced that on Price Hill this season, a boy was seen to shoot at various birds and kill them, and in one instance shot a bird by its nest of eggs, that the man who accompanied the boy apologized by saying that the boy was learning to shoot.

I also mentioned a boy near where I live who had a stone slinger and out of school hours had devoted parts of his time to using his stone slinger. He hit ten birds, eight of which fell to the ground wounded.

Up to the time of our last meeting, his playmates say he had killed about fifty birds. Since then he had been at work, and has been known to break a bird's leg tie a string around the leg and let the bird go. Only a few days ago, he shot a sparrow in the eye, and not only put out the eye, but he must have injured the bird's brain, as the poor little thing could no longer fly and hopped about with its eye out, and a crowd of little boys about it, who picked it up and examined its wound.

Now such indiscriminate killing can not be justified in any way. It cannot be just to the subject or to Audubon to cite him, a lover of birds, in such connection. As well might we justify boys who stone frogs, or throw stones at horses, on the ground that some

naturalist might be found among the attacking crowd who might subsequently enjoy studying the anatomy and skeleton of a horse.

If the Doctor pleads for the bad boy, that very often he is thoughtless and does not realize the mischief he is doing, I will join hands with him over that, as I think a great deal of boys and believe much of their mischief is due to thoughtlessness and a lack of knowledge of the nature of the evil they are doing. And the Audubon Society is of the same opinion. But the Doctor wants the subject of the bad boy dropped right here. Here is where we take the subject up.

We believe the public has a duty to perform towards these bad boys and that duty consists in explaining to them the nature of the evil they are doing and by remonstrance and presuasion to get them to desist from this evil habit. One object of the Audubon Society is to inform the public as to the manner in which our birds are destroyed, and to persuade each member and the public to use their influence to protect the birds.

And now let us approach a very important branch of the subject. Dr. Langdon quotes the following figures together with his criticisms as follows:

"Mr. William Dutcher states (quoted also by your committee,) 'that 40,000 terns were killed on Cape Cod in one season; that at Cobb's Island off the the Virginia Coast, 40,000 birds,' mainly gulls and terns, were contracted for by an enterprising woman from New York, to ship to Paris; that 11,018 skins were taken on the South Carolina coast in a three month's trip of one dealer; that seventy thousand were supplied to New York dealers from a village on Long Island.

Note, if you please, that these large figures apply to '*coast*' birds, mainly or entirely, therefore composed of gulls, terns, and the 'shore' birds."

Dr. Langdon further says; "My friend, Mr. Geo. B. Sennett, is also quoted in this article as stating that he overheard the agent of a millinery firm endeavoring to make a contract in Texas for ten thousand plumes of egrets (a species of heron, or fish-eating wader.)"

Now the Doctor knows that shore birds include numbers of our waders and that these birds are not limited to the ocean coasts, but in their spring migration pass upward through the United States, and many breed in the United States, while others pass northward

to breed. They live along the Great Lakes, in the damp grounds and marshes of our land, and winter along the southern coasts, and in the marshes and humid ground of the Southern States. Now, as to the gulls, let me say, that I for one delight to see them in life as they fly hither and thither over the ocean, here poised in flight, there skimming the surface of the emerald waves, now plunging for a moment into the ocean, again battling with the rising tempest. I say I have infinitely more pleasure in seeing them thus than to see their wings or heads, or tails upon a woman's bonnet.

We are not, I submit, mere animals to eat and drink and nothing more. Whatever contributes to our mental and higher nature and to our spiritual enjoyment, is of high utility and value. Now I hold that there is more real elevation and enjoyment afforded by a sight of the gull at home as he in varied flignt moves over the ocean than when his head or tail is located on a lady's hat.

And I maintain this position is true of birds in general, even though none of them were endowed with song, and none of them were useful as scavengers or as destroyers of insects. Their living presence is better than their lifeless skins. Audubon expressed the opinion of all true lovers of nature when he said, "the moment a bird was dead, however beautiful it had been in life, the pleasures arising from its possession became blunted."

Another use of the gulls is stated in "Science" and is this. Their destruction and consequent absence from the coast waters the bluefish fishermen say, is: "A serious evil to them, as formerly when they saw these hovering flocks, they knew that the bluefish were there and could easily be secured." And as to the shore birds I have more to say. They are when living useful to man.

The gulls, terns, and shore birds are termed by Dr. Langdon, "the scavengers of the ocean, and ornithological tramps; * * * whose only 'song' is a 'mere screech or squawk' * * * and which are not in any degree beneficial to man except for their feathers." This last statement, I call in question. I have already shown some of the ways in which the gulls exhibit their usefulness to man, and a few quotations from Nuttall will indicate the value of the cranes and herons. As to the Whooping Crane, Nuttall says, "They swallow also mice, moles, rats, and frogs with great avidity, and may therefore be looked upon at least, as very useful scavengers. They are also, at times, killed as game, their flesh

being well flavored, as they do not subsist so much on fish as many other birds of this family."

Of the Great Heron, Nuttall says, "On land our Heron has also his fare, as he is no less a successful angler than a mouser, and renders an important service to the farmer in the destruction he makes among most of the reptiles and meadow shrews."

These habits are generally those of all the members of this great family.

The Doctor says as to the water birds they are doomed to extirpation whenever civilization drains and cultivates their nesting and feeding places. I would like to ask when that time will be? When will all the wet and humid ground in our country be all drained and cultivated? We may expect a good deal of humid ground and the presence of water courses and marshy shores, and lakes so long as rain falls.

But this is not near the full extent of our argument. The fashion of wearing birds' heads, wings, and tails has become more and more fixed. The heads of the shore birds and the gulls, and terns are undesirable for hats. The length of the bill is an objection and many of the birds and their heads are too large.

Let us pause a moment to consider the condition of society and the feather business at the time these 110,000 American birds have been killed. With these birds there have been worn others from foreign countries, humming birds, parrots, macaws, doves, and plenty of other species.

We have in existence certain enginery for the destruction of birds. We have a habit created of wearing dead birds. People with money to buy what fashion demands, and without a thought as to the unfitness of the article for dress, and careless as to the destruction of bird life caused by this fashion.

We have immense feather millinery establishments, located for the most part at New York City, establishments striving to sustain their trade; and we have the boys and men employed to shoot the birds. Out of the $1,000,000.00 made last year on the sale of American bird skins and feathers, about 40 per cent. went to the gunners and trappers, that is, $400,000.00 were paid to boys and men to collect American birds and feathers.

If the supply of water birds decreases, is it not the most natural thing in the world for this army of shooters to turn upon

the insectivorous birds and collect them? Everything favors it. A debased public sentiment, making a demand for birds' heads and the like, a reality, and more than that, a vast pecuniary inducement, a set of feather milliners who propose to serve the public demand, and an army of shooters whose living is made out of the business.

We can rest assured that unless the pernicious habit of wearing birds' heads is checked by a healthy public sentiment, the next few years will see the shore birds and the water birds largely destroyed and great inroads made upon our song and insectivorous birds. And the people will awake some morning to find our song-birds gone.

I quote again:

"One New York taxidermist had 30,000 skins of crows, crow-blackbirds, red-winged blackbirds, and snow buntings."

Ah! here we have it, drifting from the killing of water birds into the killing of land birds. Even the Doctor admits that the red-winged blackbird has a desirable song—a clear whistle, and admits that the snow bunting is an insectivorous bird. Yes, drifting into killing our insectivorous birds and song birds. An ounce of prevention is worth a pound of cure. If when thus warned we do not look ahead and prevent the evil, we deserve to lose our birds.

Thus far we have taken figures which the Doctor admits to be correct, and have argued upon these. Now we propose to dispute certain of his figures and a good many of his propositions.

First, he says, "We may estimate that the 15,000,000 square miles comprised in North and South America and the West India Islands will average at least 200 birds to the square mile," and again he says, "According to this estimate then we would have a bird population in the Americas of 3,000,000,000." In answer to this, I may say that I think that 200 birds to the square mile is much too large an estimate. Many of the species of birds which winter in the Southern States are in the Northern States in the summer. In the northern part of the United States but few birds are found in winter.

In the next place, in parts of North America but few birds are present. For example, in the vast, high and widely extended slopes of the Rocky Mountains, where the flora is scarce, so, also,

is the fauna. On the great alkali plains of the West, there are practically no birds.

In the Adirondacks, a region 60 miles square, occupying a large part of the northern half of the State of New York, bird life is scarce. In reference to this region, Prof. C. Hart Merriam, in his preliminary list of birds ascertained to occur in the Adirondacks region, north-eastern New York, says: "One point in the present list requires explanation. The terms, 'common,' 'abundant,' etc., do not have the same signification as in a treatise on the birds of Southern New England for example. Birds of all kinds are rare in the dense evergreen forests of the Canadian Fauna. One may travel hours, and sometimes a whole day, among these lonely mountains and scarcely see a single bird." (See Nuttall Ornithological Club, Oct. "81," Vol. 6, No. 4). This statement is confirmed by my own observation in these forests. In view of these facts, I hold that the bird population is no greater than 2,000,000,000.

Furthermore, it must be remembered that but comparatively few birds of South America visit the United States and but comparatively few of the birds of the United States visit South America. So when our insectivorous and song and water birds are decimated and destroyed, what are we going to do about it? Why the feather milliners will send to South America for bird skins and feathers. Will that give us our birds back? And if by dint of laws and rigid protection some species of our song and insectivorous birds again multiplied and replenished this land, this much desired event would not be likely to occur in our day.

The Doctor says: "Prominent amongst the statements made in Mr. J. A. Allen's paper and quoted by your committee in the use of birds for millinery purposes, is the assertion that 10,000,000 American women are of a 'bird-wearing age and proclivities.' Some might consider this an exaggeration, which it probably is, but for the sake of a basis we will admit it to be true. Mr. Allen further estimates, allowing for the making over necessities of the economically disposed ladies, that 5,000,000 birds per year will be required to satisfy this demand."

Now I hold that 10,000,000 women of bird and feather wearing proclivities will use nearer 15,000,000 birds annually than 5,000,000. I hold that the estimate that 5,000,000 of birds represents approximately the number destroyed is far too low an estimate; and Prof. Allen himself thinks so too, as I shall presently

show. A woman very often wears two or more birds on her hat or dress, and often wears more than two wings. In fact it is quite customary to do so. I have often seen the heads of two birds on the same hat.

In my former remarks I quoted from the testimony of the Evening Post of April 7, where the writer says: "My visit to the National Academy was spoiled yesterday. Not by viewing bad pictures, either. It was by a young lady's hat. There was nothing in her face to denote excessive cruelty. Indeed, she was very pretty, and the attention she paid to the best pictures seemed to indicate that her artistic taste was not uncultivated. But her hat! The front rim of this was decorated with the heads of over twenty little birds. I counted them at a risk of seeming to stare rudely. These heads were simply sewed on side by side a closely as possible."

A lady of my acquaintance communicates the following:

"Last March a gentlemen residing on the Hudson River requested a lady who had access to the fashionable ladies of New York City to put in a plea for the birds. In a large gathering she made this statement that a lady present had said that she and her daughter had in use on their winter costumes, 44 birds."

An article in one of our local newspapers last month under the head "Boston Correspondence," mentioned that one lady wore blackbirds in the festoons of her dress.

Mr. F. M. Chapman sent to the Forest and Stream the following list of native birds seen on hats worn by ladies in the streets of New York. "It is chiefly the result of two late afternoon walks through the uptown shopping districts, and while very incomplete, still gives an idea of the species destroyed and the relative numbers of each:

"Robin, 4; brown thrush, 1; bluebird, 3; blackburnian warbler, 1; blackpoll warbler, 3; Wilson's black-capped fly-catcher, 3; scarlet tangler, 3; white-bellied swallow, 1; bohem an waxwing, 1; wax-wing, 23; great northern shrike, 1; pine grosbeak, 1; snow bunting, 15; tree sparrow, 2; white-throated sparrow, 1; bobolink, 1; meadow lark, 2; Baltimore oriole, 9; purple grackle, 5; bluejay, 5; swallow-tailed fly-catcher, 1; kingbird, 1; kingfisher, 1; pileated woodpecker, 1; red headed woodpecker, 2; gold-winged woodpecker, 21; Acadian owl, 1; Carolina dove, 1; pinnated grouse, 1; ruffled grouse, 2; quail, 16; helmet quail, 2; sanderling, 5; big yellow-legs, 1; green heron, 1; Virginia rail, 1; laughing gull, 1; common tern, 21; black tern, 1; grebe, 7.

"It is evident, that in proportion to the number of hats seen, the list of birds given is very small; but in most cases mutilation rendered identification impossible.

"Thus while one afternoon 700 hats were counted, and on them but 20 birds recognized, 542 were decorated (?) with feathers of some kind. Of the 158 remaining, 72 were worn by young or middle-aged ladies, and 86 by ladies in mourning or elderly ladies; or, percentage of hats with feathers, 77 3-7; without feathers, 10 2-7; without feathers, worn by ladies in mourning or elderly ladies, 12 2-7."

Now, of these birds seen by Mr. F. M. Chapman, Dr. Langdon is forced to make the following admission, I quote:

"The aggregate number of individuals belonging to this lot is stated at 174, which may be classified as follows: Song birds and useful species, 30; useful but not song birds, 38; birds of doubtful and negative value, 106." So that the Doctor admits that 68 of these 174 birds were undeniable useful species, that is to say, 33 per cent of these birds were well known to be useful to the farmer, the agriculturist, the horticulturist, or to the forester, and 15 per cent to be song birds. Furthermore the Doctor does not deny that the species observed by Mr. Chapman were our own North American birds, with most of which we all are familiar.

An examination such as that of Chapman is like that of a merchant sampling. He selects at hap-hazard here and there and he thus tests the whole lot. The examination is a very satisfactory one and a *very alarming* one. It shows that the use of birds is not confined to coast birds, but that already ⅓ of the birds worn by our women are birds of our farms and are insectivorous birds, and many of them are song birds.

In "Science" we find, "One gunner informed me that during the winter of 1883 he shot for a middle-man over a thousand cedar birds (*Ampelis cedrorum.*) If they had been permitted to live until next season of reproduction, it is fair to assume that each pair would have reared an average of five young, or an aggregate of twenty-five hundred birds. It is a well known fact that cedar birds are very voracious eaters, and feed almost exclusively, during some months of the year, on the span-worm, canker-worm and small caterpillars. The damage done the agricultural interests of the country by the destruction of these birds is enormous."

Let us make a new computation of the rate of mortality among birds from unnecessary causes. We take as our basis of the bird

population of the Americas, 2,000 millions instead of 3,000 millions adopted by Dr. Langdon. And the number destroyed for millinery purposes, 15,000,000 per annum. This alone gives a mortality rate of $7\frac{1}{2}$ per thousand.

The small bad boys of the country are certainly as numerous as the fashionable ladies, and are not less fatal to bird life. What with their pea-shooters, rubber-guns, and slings, and their nest robbing propensities, it is certainly fair to assume that they produce a mortality of 10,000,000 per year. This would raise the mortality rate from $7\frac{1}{2}$ to $12\frac{1}{2}$ per thousand. Then sportsmen certainly kill enough birds to raise this figure to 13 or 14 per thousand.

It has been asserted by Dr. Langdon that a mortality of 20 to 25 per thousand in the human race excites no comment, and the question is asked why should a mortality of $3\frac{1}{3}$ per thousand among birds cause such a furore. Let us examine into this a little further. We have seen that the mortality among birds due to the causes which we are fighting is probably not less than 13 per thousand instead of $3\frac{1}{3}$. Moreover this is a mortality in excess of the natural or unavoidable mortality among the birds. So that the question instead of being as propounded becomes this, if a human mortality of 13 over and above the average mortality commands attention, why should it not when occuring in the bird tribe? Now does such an increase in human mortality command attention? This question has been answered for me by Dr. W. S. Christopher by a comparison with a few figures from the Health office of this city. The average mortality in Cincinnati during the ten years included between 1875 and 1884 was $19\frac{78}{100}$ per thousand. During the year 1882, the mortality was $24\frac{52}{100}$ per thousand, or $4\frac{74}{100}$ above the average, but a little more than one-third of the useless mortality among birds, and we all remember whether the small-pox epidemic of that year was startling or not. Would an epidemic three times as severe be sufficient to call the attention of citizens to the death rate? I think it would. I am also informed that such an increase in the death rate is only the result of epidemic influence; now we must remember that such an epidemic, if I may use the expression, is now afflicting the birds, or has been afflicting them for a number of years and instead of decreasing, it bids fair to increase and to continue. With such a case I ask you, are we not right in asking protection for the birds?

"Science" gives the following inventory, furnished by an ornithological friend, of what recently met his eye in a Madison Avenue horse car in New York City. "The car contained thirteen women, of whom eleven wore birds, as follows: (1) heads and wings of three European starlings; (2) an entire bird (species unknown,) foreign origin; (3) seven warblers, representing four species; (4) a large tern; (5) the heads and wings of three shore-larks; (6) the wings of seven shore-larks, and grass finches; (7) one-half of a gallinule; (8) a small tern; (9) a turtle-dove; (10) a vireo and a yellow-breasted chat; (11) ostrich plumes. That this exhibition was by no means exceptional as to number or variety is obvious to any one who has given close attention to the ornithological displays one daily meets within street cars and elsewhere, wherever he may travel."

This examination also corroborates two points of importance:

First, that out of the eleven women wearing birds, five women wore more than one bird apiece, and these five women wore 21 birds, so that 27 birds were worn among the eleven women, making more than two apiece.

Secondly, out of the 27 birds worn, 18 were useful species and eight of these were song birds. In this instance 66 $\frac{2}{3}$ per cent of the birds worn were useful species.

Now it will be observed that these examinations were made of birds as actually worn on ladies' hats, and had nothing to do with a simple examination (within a month) of a few boxes of bird skins in a milliner's shop taken at random from a stock of boxes of bird skins such as Dr. Langdon observed. Very likely, at this season of the year, most of the native birds were sold out. The Doctor found at that examination a great many useful insectivorous species, and he found not only that some of these were North American birds, but he found that out of the 137 birds he examined only 20 were coast or water birds. How does this tally with the first half of his argument? The fact is that it goes to show that the terns and gulls and shore birds form only a small part of the birds killed and that the inland birds, the insectivorous, the useful birds, are killed for the millinery trade and worn on hats in enormous quantities.

Last year, before this subject was up, I stopped in front of a millinery store in this city, and among the birds there exposed on hats for sale, I noticed a snowbunting and a woodpecker dyed red. Now both of these birds are useful, even if it be admitted as my

friend Forbes remarks, that the woodpecker is a great bore. The dyeing of birds is a very common practice and the plainer birds can be fixed for market by dyeing them. Consequently when the Doctor says—I quote "That our most desirable song birds, such as thrushes, wrens, greenlets, and finches, are in limited demand on account of their plain colors," his assumption that their generally plain colors will exempt them from being used for trade is unfounded, first because the birds can be dyed, and second, because they are now used without dye, as is shown by the examinations before given in one of which one woman wore 7 song birds (representing 4 species) and another the heads and wings of 3 shore-larks, and another the wings of 7 shore-larks and grass finches.

Since our last meeting, Prof. J. A. Allen one of our most careful and observant and accurate ornithologists, and now Curator of the Department of Mammalogy and Ornithology of the American Museum of Natural History, Central Park, New York City, has written me the following:

"New York, June 8, 1886."

"Mr. W. H. Fisher,
Cincinnati, Ohio.

Dear Sir:

Your letter and the newspaper clipping in relation to Dr. Langdon's performance were a great surprise to me. I am just now too much pressed by imperative duties to write at great length on this subject. The Doctor, however, is entirely wrong in his assumptions. The figures given in 'Science' are not exaggerations; neither do these statistics relate to terns and herons merely. Our song-birds are sacrificed for millinery purposes by the million annually, and form a very large proportion of the birds lately worn on hats. As an index of what goes on in this line, please note Chapman's article on 'Birds and Bonnets' in Forest and Stream of Feb. 25, 1886, and republished on the last page of our Bulletin. Also, the statistics given of birds on hats seen in a New York Horse car. These are actual facts, and show plainly enough whether our native song-birds are used to any extent for hat decoration. These are examples merely of what might have been seen at any time in this city, up to a recent date. Taking the native passeres and woodpeckers together, they more than twice outnumber the birds of all other kinds worn on hats, including even all those of foreign origin. Of this there is no question. They are

species, too, that are the most common, well known and useful of our native birds. It was not at all uncommon to see here in New York last winter from *three* to a *dozen* small birds, such as Warblers, Kinglets, Sparrows, Bluebirds, etc., on a single hat, either entire or represented by heads and wings. A dozen kinglets have been reported to me as seen on a single hat. And day after day in riding in cars here I noted six and eight birds to a hat, or at least the wings of that number, and sometimes heads and wings representing a dozen song-birds. The statistics we give in 'Science' go but a short way to adequately set forth what we know to be the real state of the case in regard to the destruction of song-birds. In haste,

Sincerely Yours, J. A. ALLEN."

The position taken that, upon the assumption of certain large numbers of birds still present in our country, no danger exists that many of the valuable and useful species will become practically extinct, can not be maintained in the face of the facts found in New Jersey. In that State the wholesale destruction of bird life was carried on until, as Hon. John W. Griggs, President of the New Jersey Senate, says:

"The complaint came up from all parts of the State, of the decrease in the number of song and shore birds. Representation was made to me that certain persons had contracts to furnish birds by the thousands to taxidermists in Philadelphia and New York, and that they propose to gather their skins in New Jersey. The bill introduced into our legislature for the protection of the birds, passed with only one negative vote, and the effect in my own locality (Patterson) has been excellent."

This corroborates the position that the machinery for collecting bird-millinery having to a great extent exhausted the stock of coast birds would next gather in our other birds.

As bearing directly upon the main features of this discussion, I here take the liberty of reading to you a letter from Prof. C. Hart Merriam, M. D., in charge of the Division of Economic Ornithology, of the United States Department of Agriculture, viz.:

"U. S. DEPARTMENT OF AGRICULTURE.

WASHINGTON, D. C., June 11, 1886."

"WM. HUBBELL FISHER, Esq.,

Cincinnati, Ohio.

DEAR SIR:

I am much surprised to learn from your letter and enclosed clipping of the 8th inst., that so good a man as Dr. Lang-

don has attacked so good a cause as that of the Audubon Society.

"Dr. Langdon's statement that native American birds are almost entirely absent in millinery establishments is not borne out by the observations of myself and others in the Eastern States where nearly half the birds worn on hats are our own song and insectivorous species. His assertion that ten million bird wearing women will not cause the annual slaughter of more than five million birds is absurd, for most women who wear feathers at all (and I rejoice to observe that their number is growing smaller every day) wear those from several different birds at the same time, and I have repeatedly seen the heads or wings of five or six birds on a single hat, and in one instance I counted eleven!

* * * * * * * *

"Judging from the very brief abstract seen of Dr. Langdon's address, it seems to me that in his argument he has lost sight of the most important factors affecting the balance of bird life—a factor which undermines his statistics and vitiates his conclusions,—namely, the causes *other than the willful acts of man* which check the increase of birds. These causes are so numerous and so disastrous to bird life that their combined action renders the struggle for existence peculiarly severe, and owing to the inevitable results of what we are pleased to call the 'advance of civilization,' this struggle will become harder each year. Hence it is certain that, if not soon checked, the willful destruction of birds by man for commercial purposes, superadded to the above unavoidable causes of decrease, will result in the total extermination of many species and in the reduction to the extreme rarity of many others. In a number of cases this result has been already partially accomplished.

"In the animal kingdom, and in fact throughout organic nature, it is the rule that every species has its natural enemies which serve to check its excessive multiplication. By this means a sort of balance is maintained in the scale of nature. But when man steps in to add his potent influence in the destruction of a species the equilibrium is broken and the fate of the species seems to be merely a matter of time.

"The chief causes, other than the willful acts of man, which tend to check the increase of birds, are:

1. *Animal enemies* (mammals, birds, reptiles, batrachians and fishes which prey upon the eggs, young, or adults):

2. *Meteorological agents* (severe storms, particularly during migration and in the breeding season); and

3. *Human agents* which are unintentional and largely unavoidable (such as light-houses and electric light towers, furnace stacks, bridges and other structures, telegraph wires, the destruction of forests, forest fires, prairie fires, mowing of grass during the nesting season, the destruction of breeding sites, etc.)

"You will find a suggestive article by H. W. Henshaw, 'On some of the causes affecting the decrease of birds' in the Bulletin of the Nuttall Ornithological Club, for October, 1881, (vol. VI, No. 4, pp. 189-197).

"Trusting that you will succeed in breaking down Dr. Langdon's argument, I remain,

Very Respectfully,

C. HART MERRIAM, Ornithologist."

In Scotland a society has been recently formed for the preservation of the native birds.

The Queen of England has pronounced against the wearing of birds.

The Audubon Society has much opposition to overcome in the form of organized selfishness. It is accomplishing much

Let the good work go on.

WM. HUBBELL FISHER.

SEVENTH PAPER.

By PROF. JOS. F. JAMES.

(Read June 16, 1886.)

(Abstract.)

The text of the paper was the assertion by Dr. Langdon, that there was little or no danger of any notable decrease in the number of birds in the world, by man's action through any cause at present within our knowledge. The writer showed that in the extermination of the Great Auk, and the wild pigeon, as well as in the notable decrease in numbers of various other species, that man's influence had been all powerful. Quotations were made from various authorities showing how thousands of the Great Auk had been slaughtered by sailors for food, until none are left. The accounts of Audubon and Wilson of the immense flocks of wild pigeons which once frequented the Mississippi Valley were read to show man's potent influence here. For not only were the birds them-

selves destroyed, but the eggs and nests also, by thousands, and in the most wanton and reckless manner. The testimony of Audubon as to the manner in which the eggers of Labrador had desolated the islands off that coast was also given and the opinion quoted that unless some stop was put to the destruction the total extinction of the birds would result.

The writer then went on to show how baneful had been man's action in decreasing the number of fur seals and sea lions in the Alaskan Islands and the South Shetlands. In these places where the animals had once existed in immense numbers, such has been the destruction, that in the latter islands they are nearly extinct and in the former are only preserved from the same fate by laws passed for their protection. This portion of the paper was acknowledged to be somewhat foreign to the subject in hand, but was useful in showing that the power of man was great when exerted in the direction of the destruction of life. Reference was further made, on the authority of Prof. James Orton, to the immense destruction of turtles, by reason of their being sought by man, in the valley of the Amazon.

EIGHTH PAPER.

Dr. F. W. Langdon's Remarks.

(At the Meeting, June 16, 1886.)

In the discussion which followed the reading of the second series of reports of the committee, Dr. Langdon said:

Mr. President—It is evident from what we have just heard that my statement at our last meeting, that "this is a large subject," was a very true one.

It is not my intention to weary you at this late hour with any extended remarks.

Before opening the discussion, however, I hope it will not be considered out of order for me to return thanks to the Society of Natural History for the compliment implied by the calling of a special meeting to consider my remarks. I did not presume them to be of so much importance. I should also not omit to thank the essayists of the evening for the very valuable array of original ornithological facts and thoughts presented, which are quite an improvement upon their former report.

The statement of one member of your committee that my

previous remarks will have a "pernicious" effect I can not believe, as they have certainly had, so far, the very *good* effect of influencing the committee, as well as other members of the society, to *think for themselves* upon the subject, and not simply take for granted the misapplication of statistics by writers in popular journals and elsewhere.

This is not a mutual admiration society, but a society for the discussion of scientific topics, and no subject can be said to be fairly discussed of which one side only is presented.

I would ask your attention therefore for a few moments to some of the main points in the committee's papers so far as they apply to the question at issue, *i. e.* the probable extinction or notable decrease in number of our native song birds by reason of their use for millinery purposes. Dismissing then all reference to the extinction, by man and other causes, of the wingless or non-flying (and non-singing) birds, such as the Dodo, the Great Auk, &c., and of the mastodon, mammoth, and so on, as entirely foreign to the subject, and waiving the discussion of the market price of mud turtles and other commissary supplies—what then have we left in this second series of papers by your committee?

Chiefly citations of reduction in numbers of birds used as food, such as the wild pigeon, prairie chicken, wild turkey, and so on; species whose destruction is inevitable in any civilized country; which are *not* song birds, and which were exterminated just as rapidly before the days of bird millinery in this country. Moreover, as stress has been laid upon the *economic* influence of this destruction, it is pertinent here to cite the fact that man *replaces* these species with *tame* pigeons, chickens, turkeys, and so on, of more value, economically considered, than the wild ones.

The statement of your committee that "all birds are useful" is no more true than that all plants are useful—that is, useful to man; that all have their use in the economy of nature is indisputable, but we do not for that reason intentionally sow our fields in weeds, and there are "ornithological weeds" as well as botanical. In support of his proposition I have already cited the fact that many species of birds make their "use" felt by man by destroying the very song birds he wishes to preserve, and in evidence I would refer to the various standard works which treat of the life histories of the jays, shrikes, some hawks and owls, crows and other predaceous species. To the query of one member of your committee, "What birds are not useful?" I would further cite the fact that

even the proposed "Audubon Societies" do not advocate the protection of the European sparrow; they do not even give him credit for what good he undoubtedly does do.

The pleasant sarcasm of my ornithological friends I enjoy as fully as any of you; but sarcasm is not argument. To the various misquotations and misinterpretations of my former remarks I have no reply to make, since they carry their own refutation upon their face; and I should be very sorry to believe them malicious in their intent.

While one member of your committee considers as excessive my estimate of three billion as the total bird population of the Americas, another member cites as credible Wilson's computation of wild pigeons in a single flight at over two billion; and a third member corrects me by placing the entire bird population of the Americas at two billion only. Until the committee can reconcile their own differences in this respect I shall think it useless to attempt to do so for them. As for my estimate being a "mere guess," the same argument applies to their own. I would state, however, that I consider my estimate a very moderate one, based on personal observation over a wide extent of country at various seasons, and quite as fully entitled to credence as the estimate of ten million bird-wearing women in the United States, advanced by Mr. Allen, and offered as evidence by your committee.

Again, while the marine species and water birds generally (non-singers) are cited by tens and hundreds of thousands, the fact remains that the birds especially under consideration (North American song birds) are mentioned by dozens and rarely by hundreds, in connection with their use for millinery purposes. The ten thousand Nonpareil Finches mentioned by your committee as trapped in Louisiana and Texas for *cage* purposes have nothing to do with the millinery question, nor do they effect the fauna of the Eastern localities where the alleged decrease of small birds is taking place. Moreover, in these older Eastern States, where collectors and ornithologists have been observing birds closely for fifty years or more, no notable decrease in the familiar song birds has been recorded by this reliable class of observers. As for the statement of a member of the *New Jersey State Legislature*, which applies only to the immediate vicinity of one city, it comes from no recognized ornithological source; and I would further submit to your careful consideration that the average legislator is more competent to estimate the *votes* than the *birds* in his precinct.

That several gentlemen have "*cried wolf when there was no wolf*," the following recent advertisement is, in my opinion, good evidence, as showing the lack of the figures and facts called for:

"Information wanted upon the needless destruction of birds, with facts and figures, by the Committee on Protection of Birds, of the American Ornithologists' Union. Address,

"Care of American Museum Natural History,

"New York."

In my remarks respecting the junior ornithologists or "collectors" of this country, I made no attempt to justify wanton cruelty by small boys or others; nor do I believe that "total depravity" is a universal characteristic of our boys. I have a better opinion of human nature. Such cases of cruelty as cited by your committee should be discussed by their parents, with a stick if necessary, but better by the instillation of correct moral principles. This, however, is beyond the province of this or the Audubon Society.

I would call your attention to the fact that nowhere have I advocated or justified the useless killing of our native song-birds. I have simply given it as my opinion, based upon the evidence, that such destruction, while deplorable in its sentimental aspects, occurs to such a slight extent as to make it practically inappreciable in its effects upon the fauna of the country. Neither in the figures quoted by your committee or elsewhere is this view controverted. I have not opposed the formation of "Audubon Societies" as such, for the protection of birds, I have simply criticised their extravagant and unsustained claims to economic importance, and would here direct attention to the fact that the "Audubon Societies" are simply the outcome of an advertising scheme on the part of an Eastern journal devoted to the interests of a class of people who are habitual destroyers of birds for *mere sport.*

The ornithologists of the country, both amateur and professional, are, as a rule, gentlemen, and as such their statements of *facts* are worthy of the utmost credence, which I freely accord to them. I censure no man, moreover, for his views, while claiming the privilege to criticise opinions when based on false premises.

Your committee has neither disproved my statement that statistics of destruction of gulls, terns, herons, grebes and shore birds have been misapplied so as to apparently affect song-birds; nor has it brought forward any additional facts of consequence regarding

the latter class and their use for millinery purposes. My other statement that there is no record of any of our familiar song-birds having become rare or extinct over any wide extent of our country remains unshaken; nor does your committee give the various actual causes for decrease in limited localities proper recognition.

In short, the report of your second committee is a reply that does not answer, a statement that does not refute. So far as the main points at issue are concerned, therefore, and resting *upon the evidence*, I submit to your judgment (*not your sympathy*) that the efforts of your second committee have been a failure in their avowed object of disproving my conclusions; and that the reports of your committee respecting the extinction or notable decrease of North American song-birds for millinery purposes, still contain, I am glad to say, more poetry than truth.

THE JOURNAL

OF THE

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PROCEEDINGS.

BUSINESS MEETING, *Tuesday, October* 4.

President Dun in the chair, present sixteen members.

Miss Clara B. Fletcher, Miss Amanda Frank, Miss Laura J. Frank, Mr. Herbert Jenny, and Dr. M. H. Fletcher were proposed for membership.

Miss Emily Hopkins, Miss Mollie Geoghehan, Mr. Theodore P. Anderson, Mr. Horace P. Smith, and Dr. John D. Jones were elected active members.

The minutes of the Executive Board for April, May, June, and July were read.

Mr. Twitchell read a paper upon "Noctoc pruniforme."

A meeting of the Botanical Section was announced for October 16th.

At the request of the Society, the Chair appointed Dr. Wm. Carson a committee of one to report a notice for publication in the JOURNAL of Mr. John B. Clunet, and Prof. Joseph F. James a notice of Mr. E. S. Comings, both lately deceased members.

The Secretary called attention to specimens of Gentiana crinita and G. Andrewsii, exhibited by Dr. Norton and Mr. Warder.

The President was authorized to sign, for the Society, an invitation to the International Congress of Geologists, to meet in the United States in 1888.

On motion of Prof. George W. Harper, Prof. A. G. Wetherby was invited to read a paper on the Conchology of the Roan Mountain region of Tennessee and North Carolina.

Prof. Harper asked for instructions regarding an exchange of fossils.

Referred to the Librarian and Executive Board.

Donations were announced as follows: From Chief Signal Officer, Monthly Weather Review for July; from Prof. Edward Orton, Columbus, O., Preliminary Report on Petroleum and Inflammable Gas; from T. H. Aldrich, Bulletin No. 1 Geological Survey of Alabama; from H. P. Smith, Climate and Time, James Croll; from Dr. L. Darapsky, Santiago, Chili, Verhandlungen des Deutschen Wissenschaftlichen Vereins zur Santiago; from C. L. Faber, 221 species of shells; from Mrs. J. R. Hunt, Columbus, O., Specimens of Algæ.

Adjourned.

Scientific Meeting, *Tuesday, November 2d.*

Vice President Fisher in the chair; twenty members present.

A short paper by Dr. J. H. Hunt, on the Nesting of Martins in Tallahasse, Florida, was read by the Secretary.

Mr. William H. Knight, in presenting a specimen of Dynastes tityus from Mr. G. W. Lewis, of Yosemite, Ky., made some remarks upon the Coleoptera in general.

Prof. G. W. Harper gave an interesting account of the pursuit of a caterpillar by a carnivorous beetle, as observed by a friend.

The Secretary exhibited specimens of Hamemelis Virginica in flower and of Wolffia Brasiliensis. The latter was collected from a pond west of the Big Miami River by Dr. J. H. Hunt and Mr. George Twitchell.

Mr. J. Ralston Skinner said "Mr. James' remarks on the witch hazel, call to my mind that the fork of the witch hazel is popularly taken as the appropriate wood for finding wells of water and the like in the hands of what are called *divines*, or *water-witches*; my accidental experiences go to prove that there is a measure of truth in the claims of ability to *divine*. But investigation has shown that the ability lays in the peculiar nervous organization of the person, and not at all in the kind of wood used. The wood may be of peach or willow or maple, etc., and may be dry or green. The nervous organization must be alive to that of 'Reichenbach's sensitives,' or to that of 'trance mediums,' so called,—bordering on a tendency to epilepsy.

"A friend of mine desired to find a spot for sinking a well. A man who happened to stop at his house to rest and dine, and to

whom he spoke of his desire, owned that he could find a current of underground water for him if there was one. They went to a peach orchard back of the house, where the man with a peach fork, found a stream of water, which was very sinuous in its course. My friend followed him and dropped at every step or two a bit of bark, broken from a piece in his hand, unobserved by the witch. The spot for sinking the well was selected (which by the way proved a success) and they returned to the house. Some hours afterward, my friend asked the diviner if he could follow or retrace the same line. He said he could; and upon trial he did so, my friend proving the fact to his satisfaction, by means of the bits of bark, with which he had *blazed* the sinuous winding of the course on the first trial. The distance must have been about a fifth of a mile.

"As a second instance: Mr. Charles Latimer, of Cleveland, is singularly gifted in the use of the rod. With it he located wells of water of great value to a rail-road company for water stations, and in difficult places. But he found that the rod would serve in his hands for locating coal beds, at a depth of two hundred and fifty feet below the surface, with no external marks. He did locate coal beds successfully near Youngstown, Ohio; and that where the coal deposits are sporadic, being as it were beds of small lakes or peat bogs. A party having faith in his statement, tried for the coal, found it, took the leases of the grounds, paid Mr. Latimer a large sum as consideration and a certain sum per ton output. The output has been some hundreds of thousands of tons.

"Mr. Latimer was employed by a gentleman having such a coal mine, in that vicinity, *to survey its bounds*, and he did this in my presence, I blazing the lines for him, as is done in surveying. While thus engaged Mr. Latimer, in the midst of the deposit, came on a place in which the rod showed "no coal," and tracing it, he worked out quite a large rectangular area. While expressing his surprise, I noticed the owner smile; who (the owner) then asked us to go with him across the fields to the mouth of the shaft. We descended with him down the shaft into the mine, and he then conducted us by one of the rail tracks along a tunnel in the coal. At some distance we came to quite a large square or oblong chamber made by mining out the coal. Here he stopped, and said to Mr. Latimer,—"This is the vacant place below where you found no coal". These are but specimens of facts equally singular happen-

ing in the experience of Mr. Latimer. On one occasion he was requested to locate the large water-main, running through the park in the City of Cleveland. This he did, the location proving correct with the official plats.

"There is quite a large amount of literature on this subject, extreding back some hundreds of years."

Dr. Dun now took the chair. Mr. Fisher in presenting the society with a report of the New York Forestry Commission, the gift of Mr. T. B. Basselin, spoke of the progress of Forestry in the Adironidac region, and gave an account of the chief destroyers of the forests there. These were, the charcoal burners, the pulp makers and fires.

Members were proposed as follows: Dr. John C. McKenzie, A. W. Whelpley, C. M. Cook, Clough Anderson, Dr. J. L. Cilley, Miss. Amelia Miner.

The following persons, proposed at the preceding meeting, were unanimously elected members: Misses Clara B. Fletcher, Amanda Frank, Laura J. Frank, Dr. M. H. Fletcher, and Mr. Herbert Jenney.

A report on an amendment to the By-laws, made by Mr. William H. Fisher to the Executive Board and referred to the Society, was read. The report referred to a more definite understanding of the rights of the society to priorty of publication of papers read before it.

A resolution was presented as follows and laid over for discussion to the next meeting:

"*Resolved*, That the Society have the right to first publication of articles read before it; and

"*Resolved*, That if the Publishing Committee decline the paper it shall be returned to the writer."

Dr. Dun stated that a movement was on foot to give a course of lectures, for the benefit of the Building Fund, in some public hall. A circular asking for subscriptions to the course had been prepared, and would be mailed to members in a few days. The text of the circular was then read.

Mr. W. H. Knight said that Dr. Charles Caldwell had offered to deliver a course of ten free lectures to students and teachers in the rooms of the Society. His offer had been accepted by the Lecture Committee, and the lectures would begin Saturday, November 14th.

Donations were announced as follows: Chief Signal Officer, Monthly Weather Review for August; from D. G. Brinton, Philadelphia, Iconographic Encyclopœdia, Vol. II.; from William H. Knight, specimen of *Dynastis tityus*: from Dr. O. D. Norton, two specimens Euplectella speciosa, Fruit of Myrica cerifera; from Harry DeWar & Co., specimens of Georgia Marble; from Davis L. James, United States Naval Observatory Astronomical and Meteorological Observations for 1868: from William J. Schiff, Red-shouldered Hawk; from Cliff Allen, specimen of Owl; from Zoological Garden, Black Wolf, Wild Cat, Iguana, Moustache Monkey, Bonnet Monkey, Carapace and Plastron, and Carapace and skull of Macrochelys lacertina, Carapace and Plastron of Testeudo carolina, Clarke's Crow, Texas Peccary, Java Sparrow; from Charles Dury, skeleton of White Whale; from David Ivor, Moscow, O., concretions from Blue Limestone Quarries, Pendleton County, Ky.

Adjourned.

Tuesday, December 7.

Mr. William H. Knight, President *pro tem*: twenty members present.

The minutes for the November meeting were approved.

Mr. Horace P. Smith read a paper upon Bison latifrons.

Dr. Dun then took the chair, and papers were read by title by Mr. L. M. Petitdidier, on "Photographic Apparatus and Appliances," and by Mr. T. H. Aldrich, on "Tertiary Fossils, with Descriptions of New Species."

Notes for the Zoological Miscellany of the JOURNAL were also read by title.

Dr. W. A. Dun spoke of the Natural Gas of Ohio, and of the probability of finding gas within a short distance of the city. The line of uplift known as the Cincinnati anti-clinal seems to pass through the gas fields of Northern and Central Ohio, and according to the best belief of geologists, a few miles East of Cincinnati. The suggestion was made that perhaps it would be well to investigate the country east of the city.

Members were elected as follows: Dr. J. C. Mackenzie, A. W. Whelpley, C. M. Cook, Clough Anderson, Miss Amelia Miner.

The resignations of Rev. H. D. Waller and J. W. Innes were received and accepted.

Mr. George F. Card was elected Curator of Chemistry and Physics in place of Prof. Thomas French, Jr., resigned.

A request for the formation of a section for the study of electricity was referred to the Curator of Chemistry and Physics.

The President announced that the Photographic Section contemplates giving an exhibition of lantern slides for the benefit of the Sinking Fund.

Mr. Knight, of the Lecture Committee, said that the course of lectures on Comparative Anatomy by Dr. Caldwell had been begun, and were largely attended by teachers of Cincinnati and Covington.

The President said that the proposed course of lectures for the benefit of the Building Fund had not received the expected favor, and would probably be given up this season. Prof. Cope would, however, lecture twice in the city, probably after the conclusion of the Unity Club Sunday course.

The Lecture Committee, in response to an inquiry, said the usual course in the Society's rooms was being arranged and would be soon announced.

The President also announced the formation at an early day of a class of young people for the study of zoology and botany, under the direction of the Custodian, Mr. Smith.

Donations were announced as follows: From Bureau of Education, Special Report on Educational exhibits at New Orleans Exposition; from William Hubbell Fisher, Report of New York Forest Commission for 1885; from Chief Signal Officer, Weather Review for September; from William Findley, specimens of Granite from Custom-house Building; from S. P. C. A., Ninth Annual Report of American Humane Association; from Alexander Agassiz, Annual Report of Curator of Museum of Comparative Zoology at Harvard College for 1885; from D. G. Brinton, Ikonomatic Writing; from Joseph F. James, Bulletin No. 2 American Ornithological Union; from M. Bofill, Barcelona, Contributions a la Faune Malacologique de la Catalogue; from Hon. John F. Follett, Smithsonian Report for 1883, Report of Bureau of Ethnology 1880-81, Fourth Annual Report of United States Geological Survey; from Miss Magurk, Birds of Kansas, N. S. Goss; from E. D. Cope, Vertebrata of Swift Current Creek Region of Cypress Hills, Phylogeny of the Camelidæ; from Zoological Gardens Golden Pheasant; from Davis L. James, Tufted Titmouse; from Dr. C. E. Caldwell, Lamprey Eel.

Adjourned.

THE IDENTIFICATION OF THE BRITISH INCH AS THE UNIT OF MEASURE OF THE MOUND BUILDERS OF THE OHIO VALLEY.

Continued from page 162.

APPENDIX C.

THE "RICHARDSON TABLET" THE "GEST TABLET" AND THE "CLARKE TABLET" AS RELATED TO AND CONNECTED WITH THE "GRIDLEY MEASURING STONE."

Introductory remarks on the significance of the Richardson and Gest tablets.

These tablets are pictures or ideographs. The pictures are phallic and through the phallic idea give rise to an expression of measures of time, as their chief function. These tablets are of very great archæological value, in the opinion of the writer, as affording a solution by their simple plainness of the much vexed question of the pre-historic intendment of the symbol of *the cross.* They afford an interpretation of the so frequent cross symbols of Central America; and by this help, these in turn almost assuredly interpret the more obscured Asiatic representations. No one after examining the Richardson Tablet need go astray in assigning a proper causative idea for the use of the emblem of the cross in prayers for rain in Central America. These tablets lead us to a comprehension in an important degree, quite satisfactory, of the Palenque Cross; and that in related connection with the old Mexican hieroglyphical manuscript cross of the M. de Ferjèrvàry manuscript at Budapesth Hungary. pictured in volumne 22 of the Smithsonian Contributions to Knowledge. In this last the tree of life rises out of the yoni; under another meaning of the same symbolism life rising out of death: and this is part of the significance of the Palenque Cross. Having obtained a clear idea to some extent, of the symbolic interpretation of these, we become reassured as to a like significance attaching to the yoni and lingham symbols of the Hindus, and especially to the *asheras* or *groves*, as depicted by Dr. Inman in his "Ancient Faiths embodied in Ancient Names." Indeed the phallic creative or generative symbol seems radical as to all systems of religion, ancient and modern, pagan and Hebrew and Christian. So far from being hurtful to a rationa

or philosophical view of the latter, this helps to even a more acceptable comprehension thereof. For in place of looking upon the Hebrew system as springing abruptly out from the world of thought, and the nations, as the first true revelation of a personal God to man, we become informed that this Hebrew system was a legitimate development of a world effort at formulating a mode of religious philosophy; out of material long before accumulated by the pre-semite Old Babylonians and Egyptians, who can be traced for their origin in Asia to the head of the Persian Gulf and the mouth of the Nile, where the trace is lost, unless it be recovered in Central America, and thence from the Mound Builders. The old and pure ideas conveyed under symbols, became lost, and acceptance of these symbols was made merely for what the eye saw: consequently a degredation to the sensuous, and that inexpressible offensiveness to modern ideas, which so loath any possible connection or relation of such symbols with the high ideals of the teachings of the Hebrew and Christian sacred books. We may look upon the Hebrew religion as contained in the Sacred Text, as recognizing this ancient symbolic origin as the very source out of which it sprung, and the scaffolding or skeleton on which it was framed. But in doing this it reformed the abuse of gross interpretation and reverted to the true and ancient use of the phallic or nature symbols, as setting forth a mode of exact science, which should lay at the basis of religious worship. Out of natural science or knowledge the development of the true and pure went on evolving out of the ages, culminating in the Christian Dispensation, which to-day actuates the world.

The writer would refer to the very sensible temperate and judicious remarks on phallic pictures made by Mr. Charles Rau in Chap. iv, ("The Group of the Cross.") of his article on the Palenque Tablet, published in volume 22 of the Smithsonian Contributions spoken of: two of which it seems well to quote:

(*a*) "However, it will be evident to every one who has the faculty of divesting himself for a time from now prevailing ideas that the mysteries of generation must have powerfully acted upon the imagination of men in earlier ages, and must have led, in consequence of a tendency characteristic of a certain stage in human development, to the symbolization of that life-giving and life continuing agency. In the course of time the meaning of the emblem

became modified, though it always appears to relate in some sense to the creative energy of nature."

That which proves Mr. Rau to be right is the fact that, among other things, the technical terms for these real images with the Hebrews, became in after times, and are to-day made use of in modern languages, to convey a modified and spiritual, in place of a real, significance.* Again:

(*b*) "The pudency of Christian nations of our time is by no means an innate quality, but simply the result of long-continued training."

This remark also is true. No one can carefully study the reach of phallic symbolization without, somewhat to his amazement, finding that one of the chief places for discovering multitudes of representations derived directly from it is in church ornamentation and dress. It seems the place especially devoted to this mode, slightly, and only slightly, obscured. The writer is led to make this comment from the idea that, though the remark of Mr. Rau is true in itself, Mr. Rau seems to have labored under a common misapprehension in making it, viz., that of attributing to the origin of the symbol, and its use, a gross, sensual, and truly degrading, because merely animal and sexual, conception. The writer considers that the use of the symbol was conceived of in the utmost purity of thought, as the very basis and radix of all the religious systems of worship, and of all theosophic philosophy, which the better world has ever possessed.

He would also call attention to a remarkable fact connected with the phallic literature. While the cross-bones and skull have ever been taken as emblems of mortality, the grave, and decay, they have been also taken as the emblems of femininity and its generative functions. In Hindoo representations, the skull and cross bones are placed over the pudenda, or door of life. The mountain top, gilded with light, presents the same type when con-

NOTE.—For an illustrative instance: The Hebrew Jehovah, in the most solemn passage of Exodus, gives his name as SaCR, which word means, in its first and essential signification, *membrum virile*. From the signification the word, passing over to the secondary meaning of *male*-victim, through the offering of which the Deity was *memorialized*, hence took the derived signification of "*memorial*." "The making of, or placing the SaCR, or *memorial*, before the Lord," was handed down, *idem sonans*, among the nations, and with the Roman priest became "SaCR-*facere*," or afterward, with the English-speaking race, SaCR-*fice*; thus showing that the latest modern usage points back to the ancient phallic usage as its essential element. To this can be added: The word *cherub* is, in Hebrew, a *participle* from the word CRB, the participle being CRUB (*cherub*). For the initial C use its kindred form SC, and we have SCRB, which, with the proper voweling and the Greek termination, gives us SCaRaB-*eus*, the *scarabeus*, or Egyptian beetle, emblem of divinity. The Egyptian hieroglyphical meaning of the *winged* beetle was, especially, *the flight of lunar time*; being sacred to the moon (Seyffarth); because of the moon's supposed generative influence.

trasted with glooms of deep recesses or valleys. While the phallus represented life giving or bearing energy, and the yoni passive receptivity, the contrasting ideas were paralleled with those of life and death The woman represented the door of darkness or evening, into which the sun descended as into its grave, but out of which the new-born sun arose, or Horus was born of Osiris and Isis. With all her qualities of loveliness, fascination, and attraction, she was, by force of certain similes, represented as the insatiable monster craving for and swallowing up all life, and hence her extreme emblem, Death, or the Dragon, or most horrid monster of destruction. To quote the language of the Church, she was—"*Arma diaboli*, *via iniquitatis*, *scorpionis percussio*, *nocivum genus*, *sepulchri titulus*." In this phase she was the type of death and destruction, hateful and devouring. In the Palenque Tablet and the Ferjèrvàry picture the phallus raises out of the yoni, which in turn rests upon the head of a devouring monster, or of a skull; either of which answers for the appropriate symbol intended.

THE RICHARDSON TABLET.

(See Figure xi.)

This Mound Builder relic was found by Mr. J. M. Richardson on the 31st day of January, 1879, in excavating a mound on the road leading from Wilmington, Ohio, to Harveysburg, known as the Wilmington and Waynesville Pike, about three and one-half miles from Wilmington. The bones with which the relic was found were decayed to a lime-like dust, but the teeth were yet preserved. The history of this find is contained in a pamphlet entitled "An Illustrated Description of Pre-historic Relics found near Wilmington, Ohio," published in 1879, by Dr. L. B. Welch and J. M. Richardson. This account was copied into the *American Antiquarian*, in the October number, 1881. The writer thinks there can be no doubt as to the genuineness of the Richardson Tablet. It is formed after the same general plan with the Gest Tablet, and serves to explain and interpret the latter. In it the picture is so plain that there can be no mistaking the key-fact intended to be displayed. Figure xi is a very exact reproduction of the tablet.

The picture is formed on a representation of the phallus, with testes, in the form of an inverted *Tau* cross. The testes form the base or bar of the cross. The left testis, as one looks at the repre-

FIGURE 11. THE WILMINGTON TABLET.

sentation, has the form of the male human head, male because of the chin-beard, the right one has the form of a female human head, female because of the side locks or curls. Thus under this form *man* and *woman*, or male female, is represented in one figure. So, also, from the general character of the tablet, the male head, with its abundance of hair, represents the *sun*, heat, and dryness, or earth, while the female head represents the *moon*, coolness, and moisture, or water. The male expresses active vitalizing energy, the female expresses passive receptivity. A strand of hair from the male head distinctly lines out the body or shaft of the phallus, and doing so turns and then returns on a line parallel to the first, back to the head. From the space occupied by the female head a line extends up vertically through the length of the phallus, and issues out of its summit in *waves of water* to the right and left, forming the expanse of the firmament. The space intermediate between the testes or bar and the heavens is divided into four quarters. In the first, on the female side, and next to the head, is to be found a shape like the crescent new moon. In the second, or the next above and on the same side, is a shape as of the full moon. In the third, on the opposite side at the top, is to be found a shape as of the moon in her third quarter. And finally, in the fourth, or in the compartment next to the male head, is to be found no moon at all, or the dead quarter. It will be observed that the quarter next to the male head contains a great quantity of its hair, a fractional portion of which extends up into the quarter above. The opposite quarter next to the head of the woman contains the rough outlines of a duck. The quarter above this shows a dead, leafless branch; while the opposite quarter at the top has, beside the strand of hair, a patch like a garden, and also waved curved lines as perhaps of wind. It would thus seem that beside the four quarters of the moon the slab is intended to represent the four seasons of the year. Spring, with the germinating heat rays and garden patch, summer heats by the mass of hair or rays of the sun, autumn by the duck, and winter by the leafless branch. It seems, moreover, that the figure in the summer quarter formed by the strands of hair is intended rudely to show the head of the goat sucker inverted, with its wide mouth and very short beak, the mouth wide open, as it is to be seen in the summer heats when catching insects. This bird, or, as it is commonly called, the bull-bird, has very few species or varieties; it is almost alone, exceedingly characteristic, and markedly a bird of the summer heats.

The tablet has some very peculiar number markings at the top, set, one part to one side, and on the lower part, to the left as you look at it, of the upper line, and one part to the other side and on the upper part, to the right as you look at it, of a lower line. Commencing in the center, and counting as we proceed toward the left, the *spaces* are 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, or ten spaces, while the *projections* between the spaces are 1, 2, 3, 4, 5, 6, 7, 8 and 9, or nine projections. On the other side, counting as we proceed from the center to the right on the lower line, we have 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10, or ten spaces to the turn of the row of spaces and projections downward on the side, then there are two more spaces down the side, or 11 and 12, thus making a separation of the 12 spaces into 10 spaces and 2 spaces. By a like counting the protuberances are 1, 2, 3, 4, 5, 6, 7, 8 and 9, or nine protuberances, distinctly to the turn at the corner down the side, then two more, or 10 and 11, making eleven protuberances separated into 9 and 2. The description of spaces and protuberances is conventional, for they may be taken either way, with the same numerical results. By this, we have *two sums*, which added give 18, and multiplied give 81: also 9 and 12 which added give 21, the reverse of 12, and multiplied give 108: also, 9 and 11, which added give 20: also $9+10=19$, and $11+12=23$. The sum of these is 42, and their difference 6, and so on.

This tablet is of Waverly sand stone $3\frac{1}{8}$ inches wide, $4\frac{7}{8}$ inches long and $\frac{5}{8}$ inch thick. The reverse is unmarked save by 5 deep and 3 shallow grooves. It will at once be seen that the number forms which the markings are capable of forming, are singularly a repetition of the type measures, so much used in Mound Builder construction in the Ohio Valleys. Around the edge of the tablet, making of it an embracing cartouche, is to be found a long curiously wrought and armed arrow, or dart; and because of resemblance the writer is tempted to call attention to the Mexican ideograph or symbol of *Its-co-atl*, or "Obsidian Serpent," pictured in Mr. Rau's Contribution in volume 22, of the Smithsonian Contributions, on page 51, as also to the explanatory text.

THE GEST TABLET.

(See Figure xii.)

This tablet is so remarkable as a work of advanced art that it can be ranked with those of Palenque and Copan. Examined carefully with those and it presents a likeness of artistic culture, a

sameness. So, too, it presents the same features which Mr. Rau notices as to the Palenque productions. He says: "Any one who examines the representation of the Smithsonian tablet will be struck with the want of symmetry of its sculptures and its incorrect (artistically) outline. * This asymmetrical appearance of the slab, is not at all owing to its restoration, as might be imagined at first sight, but simply to a lack of precision on the part of the sculptor. * * Though the bas relief figures on it show a commendable finish, the total aspect of the sculpture is not that of a well executed work, at least not in our sense. The Palenque Cross shows some incongruities in the proportions of its parts, and the glyphic signs and ornaments, are not disposed in an absolutely harmonious order. * * * The absence of accurateness in the execution of details observable at Palenque did not escape Morelet's critical judgment. 'The ruins of Palenque' he says 'have been perhaps too much eulogized. They are magnificent certainly in their antique boldness and strength, but I must say, without contesting their architectural merit, that they do not justify, in their details, all the enthusiasm of archæologists. The ornamental lines are wanting in regularity, the drawings in (modern artistic) symmetry, and the sculpture in finish.'" The artist had all the mental conceptions, but he lacked the perfect skill of the later Greek, or of our day, for the artistic perfection of his work. The work was "irregularly regular" to quote the apt expression of Mr. Gest; and so peculiarly so, as to confirm its genuineness. Perhaps the chief reason of all this was the lack of adequate instruments for working in hard stone. "Instruments of flint, or some other hard stone were much better suited for that purpose," says Mr. Rau, speaking of the obduracy of the stone of the Palenque Tablet. And, indeed, stone chisels were all the Mound Builders could have had for working the Gest tablet. Mr. Rau describes the tablet of the Palenque Cross as being $3\frac{1}{4}$ inches thick, and consisting of a hard fine grained sand-stone of yellowish gray color; the relief of the sculpture being $\frac{3}{16}$ of an inch.

As to material, the Gridley measure is likewise a hard fine grained sand-stone of yellowish gray color, $\frac{4}{12}$ths of an inch thick. The Gest tablet answers, for material, also to this description, though the grain of the stone may be a trifle coarser than that of the Gridley measure. The Gest tablet is $\frac{3}{8}$ths of an inch thick, and the relief of the sculpture is $\frac{2}{48}$ths of an inch, distinctly de-

fined even in detail, but not sharply. Had this tablet been found at Palenque it would have been taken as belonging to the Palenque material and style and culture.

On comparison, the general resemblance of the Richardson and Gest tablets will be at once seen. The Gest tablet, Figure xii like the Richardson, has the phallus and testes as the base of its representation, in the form of an inverted *Tau* cross. In place of the human heads for the testes those in the Gest tablet are represented by the labyrinths of ducts belonging to the organ, with a seed vesicle in the midst. These labyrinths unite by a ligament which continued forms the shaft of the phallus. At the summit a waved line or bar projects either way, in place of, and for, the waves of water in the Richardson slab. In the body of the phallus the seed vesicles are represented as developed to the stage of *embryo foe tuses*, and these again, are projected forth, or over to the sides, and are represented as in a further stage, viz., that of *four* weeks growth, or 28 days. This is shown in Figure xiii by the sketch

Figure xiii

of that period of development taken from a medical work. These projected foetuses are four in uumber, two on each side of the shaft, and are made to occupy the four quarters of the divided space, one to the quarter, in a similar manner with the occupancy of the like quarters, or compartments, on the Richardson slab, by the phases of the moon and the seasons of the year. It will be seen that the positions occupied by the foetuses, or the *men*, are always by contrast *reversed*.* From the fact that the male or-

NOTE.—This reversai is evidently to signify the *double sex*. The same thing held in Hebrew esoterism,--for, the word for "*man*" contained the numbers 113 (diameter to a circumference of 355), the lunar year in days , whereas the word, or name, "*The-woman*" contained as the sum of its numbers 311, or the *reverse* of "man":—the two, together, as 113–311, being the division or unfolding of the number 220, which last was the sum of the numbers of the letters of the Hebrew expression Y'*sod Olaum*, or "*mystery of creation*", which was the name given to the location of the number 9 on the genitals of the *cosmic man* of Cabbalah (Ginsburg).

FIGURE 12.—THE CINCINNATI TABLET.

gan is made to show the office or function of the womb, the whole emblem is androgyne; nor does there seem to be any distinctive mark of sex, or unequal power, or quality, used either on the right or left of the shaft, save the reversal of position.

This slab like the Richardson, has number markings, distinct and clear. At the base of the Tau cross there are 6 distinct spaces and 7 lines, the spaces being broad. Beneath this and on the edge of the stone are 23 distinct, but small, spaces and 24 lines. The position of these 23 spaces is such that groups of them seem to be marked by the lines of the larger spacing, viz., 3, 7, 13, and 20. At the top there are similar markings, viz., 7 spaces and 8 lines, and 24 small spaces and 25 lines. In these the groupings are: 13, emphasized, and 20. In the whole sculpture there are 16 round dots or small circles, of which two are in the testes. In the body of the phallus there are 4, and continuing the count over, toward the right and left, respectively, we have 5 additional on each side, making a count of 9 and 9.

For the broad spacing and lines we have $6+7=13$, and $7+8=15$, together 28; and 13, the number of Catamenia in the year, multiplied by 28 equal 364, or the week year, while $28\times 15=280+140=420$. Of this 280 days is 40 weeks or the period of parturition, while 420 is 210×2, and 210 days is called the period of *viability*. So, also, $6\times 7=42$, or 21×2, and the reverse of 21 is 12. Or, these spaces and lines being 6, 7, 7, and 8, are together equal to $7\times 4=28$. The smaller spacing and lines give us $23+24=47$, with $24+25=49$, or together 96 (or 24×4, or 12×8).

Thus we have the exact description of these tablets. The numbers shown on these are familiar as those used in the measures of the Mound Builder works in which the tablets were found; also as periods of lunar and solar time, and especially lunar time, as marking the natural periods of menstruation, quickening, viability, and gestation The relationship becomes closer when we find that the Gest Tablet, as to its size, has special measures from the same unit or standard with the Gridley stone; they are: length, 5 inches; least breadth, 2.50 inches; greatest breadth, 3 (2.99) inches, with two chords of 4.50 inches each.

THE CLARKE TABLET.

(See Figure xiv.)

Another and very late *find* is fortunate, timely, and of great value, as confirming the genuineness of the Richardson and Gest Tablets. It is what is to be known as the "Clarke" (or Waverly) "Tablet," now the property of Mr. Robert Clarke, of Cincinnati. It is presented in Fig. xiv. On the left side, as one looks at it, are to be seen the unmistakeable *fac-similes* of the fœtus images of the Gest Tablet, while on turning the plate, so as to have the top on the right hand and side, the presentation exhibits the *fac-similes* of the involved duct labyrinths of the *testes* in the same tablet. In this, however, the shaft seems to be changed to represent the yoni.

This tablet was discovered March 12, 1885, by Mr. J. P. MacLean, in the collection of Dr. W. R. Hurst, of Piketon, Ohio, was obtained of him and disposed of to Mr. Clarke. The tablet was broken in two pieces, which Mr. MacLean found, piece by piece, in the collection. The history of the tablet, as given by Dr. Hurst to Mr. MacLean, is as follows: "The tablet was taken from a mound on the farm of Abraham Cutlip, about one mile south of Waverly and about three and one-half miles north of Piketon, about March, 1872. It was found about three feet from the bottom of the mound, on the north side, by Abraham Cutlip and David Allen, who were cutting away the mound. Dr. Hurst obtained it from them while they were at work. The mound was on the second bottom of the river, had been fifteen to twenty feet high, but had from time to time been cut away, so that it was only about ten feet high at the time of this excavation. The mound was composed of clay. With the tablet were found 'darts, badges, and human bones.'"

There can be no doubt of its genuineness, and for this reason it is of very great value as corroborative of not only the authenticity, but also the reading of the Gest and Richardson Tablets.

If we now refer to the Gest Tablet for comparison, we will find that it is, in its main or essential features, the same with the Palenque Cross and the Ferjèrvàry picture. In all cases we have the tree of life, with a human being (Androgyne) standing upon either side. In the Ferjèrvàry picture the phallus, rising out of the yoni, has seven branches on each side; the phallus at the top bifurcating into two branches (for water waves), extending out on

FIGURE 14.—THE WAVERLY TABLET.

either side, and these, again, are separated into further subdivisions, etc. In its frame, on the three sides thereof, we have for markings 3 twelves, or 36 in all, distinctly done. By reference, for similar pictures for similar showings, on the Asiatic Continent, to Dr. Inman's "Ancient Faiths embodied in Ancient Names," we will find identity of design. (See his illustrations in Vol. I. on the cover, and on pages 156 and 160, with his explanations.) In these illustrations notice the numbers of bunches of *flowers* to mark the catamenia, so arranged as to make 13 by a count of 6 plus 7, also the numbers 18 and 21. He himself notices the number 13. "This number suggests an explanation. At every lunar period the female has an affection which by its regularity has received the name of menses, or Catamenia, and there are 13 of these periods in the year." Notice also, in Vol. II., p. 648, the phallic and yoni symbols of the Christian Church. One of these represents a monk so marked as to show a man's head with a fish's body. There are 12 marks forming the fish. He holds a string of beads, 7×2 or 14 of which are seen. She, standing in an alcove formed by the sun, the mouth of the vagina (*vesica piscis*), holds a string of beads 13 in number, and so arranged as to count 5 and 6 and 7. The rays of the sun are arranged so that 18 are seen, and these grouped to form 10, 3, and 5. There are two more but covered rays, making 20 in all. In Sharpe's Egypt one will find the tree of life, a woman in the branches pouring water. It is inverted, so that the roots are in place of the branches, the shaft projecting into the ground (Isis). All these refer to a like symbolization. The fact is, that having caught at the root ideas, or natural basis of symbolic language, our literature is full to repletion of scattered fragments, which can be gathered, collected, recognized, and referred to a whole, or perfect ancient mode of communication.

There is remarkable harmony between the number indications on these slabs with the mound measures and the Gridley standard of measure by which the mound works were constructed. But likewise there is such harmony between the measures of time indicated by these numbers and the calendar forms of the Mayas that attention is called to the fact. It is to some extent agreed on that there is connection between the Maya culture and that of the consructors of Palenque and Copan. Reference is now made to "The Maya Chronicle" by D. G. Brinton, M. D., Philadelphia, 1882. He says: "The Mayas had a mathematical turn, and

possessed a developed system of numeration. It counted by *units* and *scores;* in other words it was a *vigesmal* system." The cardinal numbers commenced with *one* and closed with *twenty*. From twenty upward the *scores* are used, as "one to the score equals 21," and so on. Now as to their calendar. Their year was divided into 18 months of 20 days each, or 360 days, to which, to make 365, *five* days called "days without names" were added. "But the calendar was not as simple as this. The days were not counted from 1 to 20, and then beginning at 1 again, and so on, but by periods of 13 days each," the 14th day beginning a new week. "28 of these weeks make 364 days, thus having 1 day to complete the tropical solar year. When the number of these odd days amounted to 13, in other words when 13 years had elapsed, this formed a period which was called 'a *katun* of days'. It will be readily observed by an inspection of the following table, that 4 of these indictions, in other words, 52 years, will elapse before a 'year bearer' of the same name and number recommences a year. A cycle of 52 years was thus obtained in a manner almost identical with that of the Aztecs, Torascos, and other nations." "20 days were a month, and 20 years was a cycle *katun.** This katun was divided into 5 lesser divisions of 4 years each. They also had a *katun* of 24 years. They had a great cycle of $13 \times 20 = 260$ years, called an *Ahau Katun*, or $13 \times 24 = 312$ years. The Maya Chronicles make from the earliest time to the coming of the Spaniards 71 katuns, which equal either 1420 or 1704 years, according to the katun used of 20 or 24 years." It seems quite evident that the great cycle of 312 years was composed of 6 cycles of 52 years each.

The peculiar make up of these calendar data brings out in relief a series of numbers, which are so connected with the Mound Builder system of measures, and the tablets spoken of, that it may at least be suggested of them that they point to a common system of use. $13 \times 28 = 364$ is the catamenial year, and 28 days would, because of being a catamenial period, be a holy week of 4 periods of 7 days each; the number 7 being "*holy*" because it was the base of so many periods of generative time, as, 28, 126, 210 and 280 days.* It is thought this conclusion is justified by the showing of the phallic system every where among all nations of antiquity. We have $6 + 7 = 13$ and $6 + 7 + 7 + 8 = 28$, on the Gest tablet. 28 is 4 times 7, and $52 \times 7 = 364$, showing a co-ordinating mode of

*Note. It seems remarkable, that this word *Katun* for a small cycle is the same with the Hebrew *katon* or *little*. It is evident that, because the phases of the moon run so co-ordinately with the generative periods, it was supposed to be the *intelligent cause*, and was therefore worshiped.

counting time, especially in the priestly or sacerdotal way, founded on the idea of phallic creative growth by periods of 7, viz., $4\times7=28$, of *menses*, $7\times18=126$, of *quickening*, $30\times7=210$, of *viability*, and 40×7 (or 28×10)$=280$, of *gestation*, and $52\times7=364$, the holy, or week year. So, also, in the great characteristic measures of the Mound works, viz., 1050 and 1080, we find a mode of the use of a year cycle founded on $52\times6=312$, for, $105+108=213$, which is the reverse of 312 and indicates it by the Mound Builder custom of reversed numbers, and again, 213 of itself is 6 times 355 the numerical value of the lunar year in days. $355\times6=213$, and 312 is a great cycle of 52×6.

The writer considers himself very fortunate to be able to close this paper with a fact of discovery in Yucatan, by Dr. Augustus Le Plongeon and his estimable and brave wife, of Brooklyn, New York. When they made the remarkable discovery of the sepulchre of the royal Kan Coh, at Chichen--Itza, they found therein a great number of personal ornaments. These consisted of worked arrow and spear heads, of fine quartz and serpentine, with shell beads, and extraordinary ornaments in jade, of marvelous polish. The point of great interest as to these is this, that though the Mayas had arrived to the great advance in civilization of splendid stone cutting and mason work and sculpture, with an elaborate hieroglyphical alphabet—an advance parallel to that of the old Egyptians and Babylonians— yet their articles of personal ornamentation *were the same* (of the same kind, material, and design) *with those of the Mound Builders of the Ohio Valley*. The labors of Dr. and Mrs. Plongeon in Central America are the most valuable of all others, and their results are so surprising, and so promising of the discovery of "*missing links*," that they should be furnished with material efficient support by the Government in the further prosecution of this wonderful field of their self-sacrificing personal investigation.

J. RALSTON SKINNER.

NOTE. *Erratum.* In a note to a former article 5011506 is said to be the square root of 51215, whereas it should be 251152.

PROTOZOA OF THE CINCINNATI GROUP.

By Joseph F. James, *Professor of Botany and Geology in Miami University.*

(Read September 6, 1886.)

The term Protozoa is applied to those members of the animal kingdom which are "generally of minute size, composed of a nearly structureless jelly-like substance (termed 'sarcode') showing no composition out of definite parts or segments, having no definite body-cavity, presenting no traces of a nervous system, and having either no differentiated alimentary apparatus or but a very rudimentary one."*

On account of their jelly-like nature they are difficult of preservation in a fossil state, and, when found, present a structure which can only be examined by means of microscopic sections. Only two orders have as yet been found fossil in this vicinity, and these only in limited numbers. The first contains one genus and one species, and was formerly placed with the Polypi. The second includes eight genera and eighteen species. The following is the first attempt which has been made to collect the descriptions of genera and species and arrange them in any order:

Sub-kingdom PROTOZOA.

Order. Foraminifera.

Minute, structureless, gelatinous animals, with the body protected by a shell generally composed of carbonate of lime. Pseudopodia long, filamentous, and interlacing.

Living *Foraminifera* are microscopic, and distributed in immense beds at the bottom of the ocean. As fossils they are found through all the formations from the Silurian to the Quaternary. They go largely toward making up the chalk formation, and in the Eocene Tertiary formed beds known as the Nummulitic limestone, which stretch from Western Europe to the frontiers of China (Nicholson). Only one genus seems yet to have been found in the Cincinnati group, although both *Receptaculitis* and *Stromatopora*, have been referred here. The genus now placed in this order is Beatricea, and it has been assigned various posi-

*Nicholson Manual of Zoology, p. 44.

tions by different authors. It was originally described as a plant; then grouped with the corals; Prof. Hyatt, in 1865, called it a mollusk allied to the Cephalopoda, and in 1884 considered it as one of the Foraminifera.

Genus 1. BEATRICEA, Billings, 1857.

Rept. Prog. Geol. Sur, Canada, 1852 56; Toronto 1857, p. 343.; A. Hyatt, Jr., 1865 Am. Jour. Arts and Sciences, 2d Series, XXXIX, p. 261 *et seq.*, Pro. Am. Asso. Adv. Sci., XXXII, (1884), p. 492.

Nearly straight, one to fourteen inches in diameter, perforated by a cylindrical and nearly central tube, which is transversely septate; outside of tube composed of numerous concentric layers.

1. B NODULOSA, Billings, 1857.

Loc. cit. p. 343.

Surface covered with oblong, oval, or sub-triangular projections one to three lines high, with rounded, blunt points nearer one end of the prominence than the other; projections varying in size, sometimes with a nearly circular base, sometimes six or seven lines long and one-half as wide, distant one to three lines from each other, arranged in rows or spirals: whole surface fretted with minute points, showing perforations when worn. Septa thin, very concave, one line to one inch apart.

Locality. Originally described from Canada. Found in Marion County, Kentucky.

2. B. UNDULATA, Billings, 1857

Loc cit. p. 344.

Surface sulcated longitudinally by short, irregular, wave-like furrows, from two lines to one inch across: otherwise like the preceding. Specimens have been found ten feet five inches long and from eight to fourteen inches in diameter.

Locality. With the preceding.

These two species have, by some writers (Knott, Geology of Marion County--Kentucky Geological Survey, p. 32) been considered one species. Prof. Hyatt, however, considers them distinct, and says they can be separated by the internal characters.

Order. SPONGIDA.

One of the lowest orders of animal life, consisting of an aggregation of animalculæ forming a soft mass with spiculæ of various forms, or possessing a silicious skeleton filled with sarcode. This sarcode is traversed by tubes of varying size, serving to convey nourishment to the individuals.

As fossils, they occur in amorphous masses of irregular shape and variable size, showing little or no structure on the exterior beyond the tube openings or osculæ, internally often of layers of matter separated by interlamellar spaces, the tubes penetrating these vertically. The internal structure can only be studied by means of thin sections, examined under the microscope.

The remains of a number of genera have been found in the rocks of the Cincinnati Group. The ten described genera are here reduced to eight, but no account is taken of those which have been named and not described. The following keys and descriptions are offered as a contribution to the study. The number of species will no doubt be increased on a further study of more material.

SYNOPSIS OF GENERA.

I. FREE, IRREGULAR OR SPHERICAL: EXTERNAL OPENINGS TO PORES MINUTE OR WANTING.

a. Surface without plates.

Round, unattached, with minute external pores.
1. Astylospongia.

Irregular, generally compressed, and having the appearance of a number united in a cluster. 2. Pattersonia.

Body circular, with arms. 3. Brachiospongia.

b Surface covered with plates.

Having an apparent base: plates polygonal or hexagonal, without special arrangement. 4. Pasceolus.

Plates imbricated, arranged in concentric, intersecting lines.
5. Ischadites.

Plates cylindrical, blunt; arranged in concentric lines.
6. Receptaculites.

II. INCRUSTING: EXTERNAL PORES CONSPICUOUS.

Formed of thin layers or laminæ; pores with external openings (osculæ). 7. Stromatopora.

Formed of thin, irregular laminæ; tubes without walls, perforating laminæ and interspaces, but not continuously.
8. Stromatocerium.

Genus 1. ASTYLOSPONGIA, Roemer. 1860. Die Silur. Fauna des West Tenn., p. 7.

Microspongia, Miller and Dyer. 1878. Jour. Cin. Soc. Nat. Hist., I., p. 37.

Globular, nearly regular, free: large canals running from the center outward, intersecting smaller, concentric canals: internal structure stellate, the rays cohering; spiculæ (?) small, star-like objects in the midst of the mass.

1. A. GREGARIA, Miller & Dyer.

Microspongia gregaria, M. & D. 1878. J. C. S. N. H., vol. I., p. 37; pl. 2, fig. 2.

Chætetes subrotundata, U. P. James. 1878. The Palæontologist, p. 1.

Astylospongia subrotundata, U. P. James. Ibid, p. 11.

Globular, compact, sometimes as if two or three united into a cluster: one-quarter to three-quarters of an inch in diameter: needle-shaped spiculæ (?) visible under high magnifying power.

Locality: Cincinnati; Ogden Station, Clinton County, Ohio.

The characters given for *Microspongia* are not sufficient to separate it from *Astylospongia*. *A. subrotundata*, James, was first referred to *Chætetes* (as above), but afterward placed in *Astylospongia*.

2. A. TUMIDA, U. P. James, 1878. The Palæontologist, p. 1.

Sub-globose, depressed, with a cavity on one side; surface rough, pitted, sometimes lobed.

Locality: Cincinnati.

Genus 2. PATTERSONIA, S. A. Miller. 1882. Jour. Cin. Soc. Nat. Hist., vol. V., p. 43.

A solid, amorphous mass of uniform structure, and destitute of openings: surface irregular; often appearing as if several specimens were united in a cluster.

P. DIFFICILIS, S. A. Miller. Ibid. p. 43. Pl. 2, figs. 3, 3 *a*.

Character of the genus. The only species known. It may, on further examination, prove to be a *Stromatopora*.

Locality: Cincinnati, O.

Genus 3. BRACHIOSPONGIA, Marsh, 1867. Am. Jour. Sci. and Arts. Series 2, vol. XLIV., p. 88.

Body nearly hemispherical; arms extending out from lateral surface; hollow, with arms opening into the body cavity.

1. B. DIGITATA, Owen.

Scyphia digitata, Owen. Second Report on Geology of Kentucky, p. 111.

Body hollow, cup-shaped, with from eight to eleven tubes or arms: arms extending horizontally one inch, and then rising vertically; body six to twelve inches in diameter.

Locality: Frankfort, Ky.

This is probably a Trenton species, and is not likely to be found in this locality. It is inserted here because it has been included in catalogues of the fossils of this group.

3. B. TUBERCULATA, U. P. James. 1879. The Palæontologist, p. 25.

Body sub-circular, with prominent tubercles irregularly distributed over the surface: arms, nine, straight; one, to three and a half inches long: specimens between five and six inches in diameter.

Locality: Todd's Fork, near Wilmington, Ohio.

Two other species, viz., *B. lyoni*, Marsh, and *B. roemeriana*, Marsh, though given in catalogues, seem never to have been described. These names can not, therefore, hold.

Genus 4. PASCEOLUS, Billings. Report of Progress of Geological Survey of Canada, 1853-56, p. 342. Palæozoic Fossils of Canada, 1861, p. 392. S. A. Miller, 1874, Cin. Quar. Jour. Sci., vol. I., p. 4.

Ovate or sub-globular. Exterior surface marked by pentagonal or hexagonal plates: base with or without point of attachment.

1. P. GLOBOSUS, Billings. *Loc. cit.*, p. 343. Palæozoic Fossils, p. 392, figure.

Hemispherical or sub-globular: two or three inches in diameter; base flattened; plate impressions polygonal or hexagonal, without external orifices, and about two lines in diameter.

Locality: Cincinnati; Ottawa, Canada.

This is mainly a Trenton species. It has been found in this vicinity in a few localities.

2. P. DARWINII, S. A. Miller. 1874. Cin. Quar. Jour. Sci., I., p. 5, fig.

P. claudii, S. A. M. Ibid., p. 6, fig.

Body spherical or hemispherical; some specimens with a circular central depression; surface marked with crowded pentag-

gonal or hexagonal plates, one line or less in diameter; diameter of fossil from one-half to one and one-quarter inch.

Locality: Cincinnati, O.; Maysville, Ky.

The form described as *P. claudii* is apparently a young and small specimen, without the circular depression.

Genus 5. ISCHADITES, Murchison. 1839. Siluria, p. 697.

Lepidolites, Ulrich. 1879. Jour. Cin. Soc. Nat. His., vol. II., p. 20.

Ovate, conical or cylindrical, often compressed: outer surface, with plates arranged in concentric, intersecting lines, like the engine turning on a watch case.

I. DICKHAUTI, Ulrich. J. F. James, J. C. S. N. H., VIII., p. 163.

Lepidolites dickhauti, Ulrich. 1879. Jour. Cin. Soc. Nat. Hist., vol. II., p. 21, pl. 7, figs. 17, 17 *a* and *b*.

L. elongatus, Ulrich. 1879. Ibid, II., p. 22, pl. 7, fig. 16.

Compressed from a spherical or sub-pyriform body, with lower portion indented; plates imbricated, about three times as long as wide, with widest end round, exposed, and arranged in concentric, intersecting lines.

Locality: Covington, Ky., about 150 feet above low water mark.

Genus 6. RECEPTACULITES, De France. 1827. Dict. Sci. Nat., t. 45, atlas; p. 68.

Anomaloides, Ulrich. 1878. Jour. Cin. Soc. Nat. Hist., vol. I., p. 92.

Hollow, sometimes cup-shaped, with plates radiating in curved lines as in ISCHADITES; numerous cylindrical bodies between the outer plates and the inner, thin, expansion,

R. RETICULATUS, Ulrich. J. F. James, Jour. Cin. Soc. Nat. Hist., vol. VIII., p. 165,

Anomaloides reticulatus, Ulrich. 1878. J. C. S. N. H., vol. I., p. 92, pl. 4, figs. 6, 6 *a b*.

Compressed, hollow; formed mainly of elongated, cylindrical bodies, sharp at the inner and rounded at the outer ends: arranged in intersecting lines.

Locality: Covington, Ky.

This and the preceding species were long of uncertain position. There seems little doubt but that they are here referred to

their correct genera. Compare with Billings "On RECEPTACULITES" (Palæozoic Fossils of Canada, I., p. 378) and Hinde in Jour. Geol. Soc, Lond. Nov. 1884 p. 395, et seq.

Genus 7. STROMATOPORA, Goldfuss. 1826. Petrefacta Germaniæ. Nicholson & Murie. 1877. Jour, Linn. Soc. of London. Zoology, XIV., p. 217. Geol. of Ohio, Palæont. vol. II., p. 245.

Dystactospongia, S. A. Miller. 1882. Jour. Cin. Soc. Nat. Hist., vol. V., p. 42.

"Skeleton ('sarcodeme') consisting of concentric calcaerous laminæ, separated by distinct 'interlaminar spaces,' which are crossed by numerous 'radial pillars.' In some cases there are radiating water canals and surface grooves placed round minor centers. Sometimes there are seen on the surface the openings of large water canals ('oscula').

"Forming irregular masses, sometimes with a foreign body as a nucleus; spreading out into extended expansions, covered inferiorly by a thin, striated, calcareous membrane ('epitheca'), or growing in thin layers parasitically upon foreign objects." Nich. and Murie on "Stromatopora and its allies." Ibid.

The position of this genus has been the subject of much controversy, and the matter is by no means yet settled. It has been placed with the Polyps and with the sponges, but late writers are inclined to regard it as the type of a separate order. See Nicholson and Murie, Ibid, and others. The following is an arrangement of the species of this group:

a. Massive forms.

1 S. INSOLENS, S. A Miller.

Dystactospongia insolens, S. A. Miller. 1882. Jour. Cin. Soc. Nat. Hist., vol. V., p 43, pl. 2, figs. 2, 2 *a b*.

Massive, irregular in form; outer surface, with radiating canals; internal structure minutely vesicular.

Locality: Cincinnati.

This species closely resembles *S. granulata*, Nicholson and Murie, as described and figured by them in the article referred to above. See their figure, Pl. 1, fig. 11.

b. Tubular forms.

2. S. TUBULARIS, U. P. James. 1884. Jour. Cin. Soc. Nat Hist., VII., p. 139, pl. 7, figs. 3, 3 *a b*.

Cylindrical or tubular, two, to two and one half inches in diameter, and one inch long; laminæ about one-twentieth of an inch in thickness, irregular, wavy, with serrate edges; interspaces thin; pores (oscula) at irregular intervals: center of the tube filled with clay, broken shells, or corals.

Locality: Cincinnati; Morrow, O.

3. S. SUBCYLINDRICA, U. P. James. 1884. Jour. Cin. Soc. Nat. Hist., vol. VII., p. 20, figs. 1, 1 *a*, *b*, *c*.

Labechia montifera, Ulrich. 1886. Contri. to Palæon, Vol. I., p. 33, pl. 2, figs. 9, 9 *a b*

Subcylindrical: exterior surface covered with prominent conical elevations, one-tenth to one-twentieth of an inch high, irregularly distributed: apices and slopes of these with radiating lines or depressions; spaces between the monticules covered with circular or elongate papillæ, one-twentieth of an inch apart: no surface pores; specimens, two and one-half inches long, curved.

Locality. Morrow and Clarksville, O.; Madison, Ind.

For the resemblances between this species and *Lebechia montifera*, see J. C. S. N. H., IX., No. 2, p. 39.

c. Incrusting forms.

4. S. LICHENOIDES, U. P. James. 1878. The Palæontologist, p. 18.

Expansions thin, on shells; one-eighth to one-quarter of an inch in diameter and one-quarter to one-half line in thickness; surface rugose or undulating, with small, irregular pores.

Locality: Cincinnati.

5. S. SCABRA, U. P. James. 1878. The Palæontologist, p. 18.

Expansions (on shells) thin; surface rough, with conical or elongated monticules, one half to one line above the surface and one to two lines apart.

Locality: Lebanon, O.

6. S. PAPILLATA, U. P. James. 1878. The Palæontologist, p. 1.

Crust thin; surface, with small, closely set papillæ, irregularly arranged, six or eight to a line; apices open or closed.

Locality: Cincinnati; Clinton County, O.

7. S. LUDLOWENSIS, U. P. James. 1884. Jour. Cin. Soc. Nat. Hist., vol. VII., p. 140; figures.

Expansions two by four inches; incrusting or in irregular, amorphous masses; surface irregular or rough; laminæ thin; pores

circular or oval, irregularly distributed; numerous minute pores, and a greater or lesser number of larger oscula.

Locality: Ludlow, Ky., etc.

This species shows there is no definite line to be drawn between the massive and incrusting species of the genus.

Genus 8. STROMATOCERIUM, Hall. 1847. Pal. of New York, vol. I., p. 48; emended by Nicholson and Murie, Jour. of Linn. Soc., London (Zoology), 1877, Vol. XIV., p. 222.

Skeleton massive, composed of dense, thick, calcareous, horizontal and concentric laminæ, separated by narrow and irregular interspaces; laminæ irregularly disposed; no radial pillars crossing interlaminar spaces; entire mass perforated by vertical tubes without walls, at short and irregular distances; the tubes place the interlaminar spaces in communication, but cannot be said to run from top to bottom.

1. S. CANADENSE. Nich. & Murie, 1877. Ibid, vol. XIV., p. 223, pl. 3, figs. 9, 10.

S. rugosum. (?) Hall, 1847. Pal. of N. York, vol I. p. 48, pl. fig.

"Skeleton having the form of large, rounded or irregular masses, conspicuously composed of numerous dense, concentric laminæ, about five of which (with the interlaminar spaces) occupy one line. The interlaminar spaces are open, without radial pillars. and the mass is traversed by numerous discontinuous, vertical canals, from $\frac{1}{50}$ to $\frac{1}{80}$ inch or less in diameter. Surface characters unknown."

Locality: Peterborough, Ontario.

2. S. RICHMONDENSE, S. A. Miller. 1878. Jour. Cin Soc. Nat. His., vol. V., p. 41, pl. 2, figs. 1, 1 *a b.*

Small, globular, hemispherical, irregular; laminæ irregular, more or less wrinkled, filled with minute tubes, surface apparently destitute of openings.

Locality: Richmond, Ind.

REMARKS ON A VARIETY OF NOSTOC PRUNIFORME.

By Geo. B. Twitchell.

(Read October 5, 1886.)

Early last spring the Society received, under the name of "Agates in an inception stage," a bottle of nostocs collected at Haidley, Idaho. In August I received another lot of the same. This idea of their connection with agates is readily explained by their appearance, for they surely bear both externally and internally a marked resemblance to the agate pebbles found in some of the western streams.

The various species of the genus nostoc are generally found in water or damp places as more or less firm gelatinous masses. These thalli vary for the different species, some being almost microscopic while others cover over a square foot of moist sand. Some are indefinitely expanded, while others are restricted by a sort of periderm to a more definite shape.

Inside of these gelatinous masses will be found serpentine rows of roundish cells, with here and there larger cells of a different color, called *heterocysts*. These filaments are usually, if not always, inclosed in sheaths to which the heterocysts adhere by their sides. The growth of these filaments is by a cell division. According to Thuret the reproduction is in this manner: The thallus becomes softened and a green jelly escapes. This is made up of detached portions of nostoc filaments that have straightened out. These have an oscillaria-like motion. They are sensitive to light, always accumulating at the brightest part of the vessel containing them. In the development of one of these *hormogones*, as they are called, the first change that takes place is the formation of a distinct gelatinous sheath about the whole of the filament. When this is formed the inclosed cells divide once or oftener, the plane of the division being parallel to the original direction of growth. The result is two or more rows of cells in a now rather distended sheath. By a reuniting of these cells a single curved nostoc filament is formed within a sheath which has now shortened and widened to a more globose form. This young nostoc secretes jelly and grows until it reaches the size of the parent. The existence of a reproduction by means of spores has been suggested by

some writers. However, it is not well understood, and, indeed, it seems probable that we are still far from a correct understanding of the whole life of these strange plants. Many may be conditions of higher plants, while the resemblance that the gonidia of certain lichens bear to the nostoc filament has given rise to much discussion as to the part our plant may play here.

Although this agate-plant hardly agrees with any of the described species, yet in the present state of our knowledge of the genus, it is not advisable to consider it an entirely new species. We will consider our plant a variety of *Nostoc pruniforme.*

The size is quite variable; the largest observed were about an inch and a half in diameter. The jelly is remarkably firm and is inclosed in a leathery periderm. The shape may be called globose. In the central portion of the thallus the filaments are curved in the characteristic nostoc manner, but, running out from here, they are arranged in almost straight lines radiating toward the periphery, when they are again twisted and tangled, probably thus helping to build up the periderm. The cells are more variable in size than those of the typical *Nostoc pruniforme.* No sheath can be seen in a vegetating specimen. The manner of reproduction is similar to what has been described for other species, with the exception that the whole process takes place within the parent thallus, the *hormogones* not even breaking loose from adjoining cells. The same filament frequently has different portions in all the different stages of the reproductive process.

The reproduction was observed in specimens collected in August, the first step being the development of sheaths about portions of the filaments. The cells inclosed then divide into rows of cells after the manner described by Thuret. In reuniting these cells do not seem to observe the regularity described for other species, but the result is the same.

Among the twisting filaments of the central portion of the thallus, the *hormogones* while forming are naturally very irregular in shape. When fully formed they are nearly spherical, and the inclosed cells are so closely pressed together that the regular filaments, which could be traced before this stage, cannot be made out. It seems probable that the parent must decay before these young plants can develop into full grown nostocs. Whether or not these are now in a condition to pass through a resting stage, I cannot say.

In the straight filaments leading out from the center, the *hormogones* in forming are not so irregular in shape as those just described. Near the periphery they are developed in great abundance. When fully formed they are not made up of a mass of closely united cells, but are young plants in which the characteristic twisting filaments can be distinctly seen. In some cases these young nostocs will be found at the very outer edge of the thallus, and it is not uncommon to find such a plant covered with other small but fully formed plants. It would seem probable from this that the *hormogones* that are formed near the periphery can develop into independent thalli before the entire dissolution of the parent.

There were many things of interest about this collection not directly connected with the nostocs. In almost every case the plants were covered with layers of carbonate of lime deposited from the water in which they grew. Quite a number of diatoms were found in the sediment at the bottom of the bottle, and occasionally one would be found inclosed in one of the masses of jelly. Irregular, whitish spots would quite frequently be found scattered through the gelatinous matter, but strangest of all were the bodies observed by Mr. G. H. Curtis. I can best describe them by saying that they appeared like multitudes of pins with their points all directed toward a common center, where they became so numerous that the individuals could no longer be distinguished. He considered them raphides. I cannot close without at least mentioning that bacteria were found in great abundance in some specimens that had become a little softened by decay. The gelatinous matter of the thallus seemed to make an excellent culture medium.

OBSERVATIONS ON PHOTOGRAPHIC APPLIANCES AND THEIR USES.

By L. M. Petitdidier..

(Read by title December 7, 1886.)

It may seem presuming on my part to offer a statement of my observations on photographic appliances to members of this Section, who have had as much, and in some cases more, experience than myself. However, if I fail to say anything of interest, you can only blame the Committee on Entertainments for their selection. My remarks will only apply to amateurs, and only relate to our general work.

Every one will readily admit that good negatives can not be obtained without a good photographic outfit, used with judicious manipulation and precision. A negative or photograph should be judged from two standpoints, one being the technical and the other the artistic; the successful combination of both constitutes perfect work. One can become artistic in his selections and general adaptation of his subject to his plate almost as well as he can become technical.

This may seem to be an exaggerated statement, but I am fully convinced that a close study of artistic effects would show that these are more or less subject to well-defined rules and conventionalities, which could be memorized, just as one learns his multiplication table.

A picture which is artistic and not well executed is in part a failure; therefore to be successful it is as essential to be a careful manipulator as it is to possess artistic attainments.

I shall confine myself to the technique of photography, and give you the result of my conclusions, let them be worth what they may.

In the selection of an outfit, let us take up the camera first—I mean the kind mounted on a tripod. A number of various boxes, nicely finished and very pretty in appearance, are always in the market, which answer all requirements. Whatever their adjustments may be, two of these are indispensable—they are a rising front and a vertical swing-back. Other adjustments, such as focusing rack and pinion, etc., are only for convenience, but they are very useful. A horizontal swing can be of much service

in some peculiar cases where one side of the view is much nearer than the other. For general use, however, they are not only of no value, but lessen the rigidity of the back of the box, besides leading to complications. My advice would be, leave horizontal swings alone, and I believe that those members of this club who have used them will concur in my opinion.

The size of a camera, which is the most desirable for any one, depends somewhat on the weight one is willing to carry, and also on the film-carrier to be used, whether glass or paper. It is very evident that if paper is to be used instead of glass plates, one can afford to carry a camera of larger dimensions. The energy and vital resources of the amateur are also to be considered in the determination of the size to be adopted. Some amateurs can carry a 11x14 box, with two dozen plates, on a warm summer day without murmuring, while others might become fatigued from carrying a quarter size box. Of course, I presume that every photographer is personally concerned in the transportation of his own traps.

The proportion of the plate to be used depends on the topographical features of the country in which the views are to be taken, and also on the disposition to be made of the negatives, whether intended principally for prints or for lantern slides. If intended for prints, and in sections of country where no high mountains are to be dealt with, a plate having the proportions of 5 to 8 or 5 to 7 is well suited, as the height desired is much less than the breadth; thus in most cases we find that when seven or eight inches are sufficient for the lateral dimension, five inches give ample margin for sky and foreground.

On the other hand, if we consider that we get as much and perhaps more enjoyment out of our work by transforming it into lantern slides, and that the shape of a lantern slide gives a better image on the screen when about square, we conclude that the heighth and width of a plate should not differ much, though there should always be a difference in order to allow of horizontal and vertical views. Besides, square pictures are seldom graceful. My observation has led me to believe that the proportions of 5 to 7 or 6½ to 8½ are the proportions which can be adapted most satisfactorily to any kind of country or view, and are at the same time well proportioned for lantern slides. In the latter case the ends of the negatives can be cut off so as to give the view better shape, as it must be observed here that a lantern slide need not embrace as

much as a print, which is examined for a longer time. In fact, too many details detract from the appearance of an image on a screen, the principal features of which are alone ot interest.

Detective cameras using quarter size plates are only good for studies, instantaneous views, and lantern slides. Prints made on such a small size are insignificant; objects and details are so minute as to be almost microscopic; furthermore, the perspective suffers very much. Any one can be convinced of this fact by looking through a slide and comparing its perspective with that shown when its image is thrown upon a screen. In fact, a 4x5 picture is the smallest admissable that will give details and perspective without tiring the eyesight. Amateurs making that size exclu sively will find it quite convenient and at the same time quite a luxury, when looking over their pictures, to use a graphoscope magnifying about two diameters. By being magnified a picture gains in depth and perspective; shadows be ome transparent, and details are observed which otherwise escape the naked eye.

Concluding, therefore, that 4x5 is the minimum size plate which will produce anything like a fair picture, the maximum size need not exceed 6½x8½, unless the amateur is very ambitious, and if so, after having acquired all the paraphernalia accompanying photographic work, he may regret his enthusiasm, and soon have a camera and lens for sale.

I have said nothing pertaining to portrait work, as it is not within the province of an amateur, who is not prepared for that class of work, and therefore can not do it as well as professionals, who devote a lifetime to it. When portraits are wanted, however, any size plate can be used. By portrait work I refer to such work as done in photograph galleries.

SELECTION OF LENSES.

Though there is a great variety of lenses used in photography, the amateur limits himself to two kinds—the single view lens and the rectilinear doublet. The single view lens is corrected for everything except what is called barrel distortion. This distortion is very apparent when long, straight lines are brought into view. Any straight line not passing through the center of the field of the lens will be carried more or less toward the center of the picture, and this distortion is greatest at the edge of the field. This lens is therefore not good for architectural subjects, or any view in which appear near buildings of large dimensions. It is said, however,

to be better for general landscapes and views than any other lens, as it gives more brilliant results, owing to its non-correction for barrel distortion, and partly, also, because the rays of light have a smaller number of lenses to go through. They are cheap, and every outdoor photographer should be the owner of at least one of them.

The rectilinear lenses most in use and in the market include a very wide angle lens and one whose angle corresponds nearly with the angle which an artist uses when painting outdoor views, landscapes, etc.

A lens is said to be rectilinear when it reproduces straight lines correctly. Therefore, a rectilinear lens must give the true perspective as seen from the point of view occupied by the camera at the time of exposure. Wide angle lenses are specially useful when making views of interiors and confined situations, but for short exposure and instantaneous views more especially they are not so well adapted as the other double combination, as they have not more than one-half their rapidity.

In order to get a good perspective effect and throw out a lot of uninteresting details on a picture, a lens should have a focal length at least equal to the greatest dimension of the plate, and a better result is obtained if the focal length exceeds this greatest dimension by from twenty to thirty per cent.

Whenever a short focus lens is used to cover a large plate, it often brings in more details than are wanted, the perspective is painfully violent, objects in the distance appearing much further away than they really are.

All lenses are supplied with a set of diaphragms or stops, which are intended to correct their spherical aberration, and increase their depth of focus, the larger stops being intended for portrait and instantaneous work where it is necessary to sacrifice definition at the edges of the field in order to gain rapidity, the smaller ones used for time exposures and where sharp definition is required to the very edges.

In comparing lenses of the same focal length the one which, with a stop of the same diameter, gives the best definition and shows greater depth of focus, is generally the best, provided it be not defective in some other way.

A first-class rectilinear lens (leaving out wide angle) should, with a stop corresponding to U. S. No. 16, give a *fair* definition

for instantaneous work all over the plate for which it is intended. For time exposures the stop U. S. No. 32 should cover the same plate with a definition, leaving nothing to be desired. Of course exceptions must be made for very large lenses and difficult subjects.

In focussing a given landscape on the ground glass every one has observed that the center of the picture requires a shorter focal length than the sides. This is due to the curvature of the field of the lens; for that reason, when the center of a picture is in exact focus, the sides will not be sharply defined, and *vice versa*. Without the use of a strong eye-piece there appears to be quite a margin or space through which the lens may be moved back and forth without affecting the definition. This space should be utilized in favor of the sides after the center is well defined.

The following is, I believe, a good method: Put in, first, a stop one size larger than the one you know ought to give sharp definition; focus for the central line of distance with focussing screw and for foreground with swing-back. By alternating once or twice in that manner every thing will be sharp on this vertical line. Then bring nearer together ground glass and lens until the definition in the center is just beginning to lose in sharpness; then clamp the camera and put in a smaller stop if a rapid exposure is not wanted.

It may sometimes happen that the swing-back can not be used for focussing purposes, as in the case of an architectural view, or when in the central portion of the view are objects at different distances, requiring different focal lengths, such as a near bridge under which can be seen a distant view. In either case a compromise should be made, treating all principal parts of the picture alike, and then using a very small stop, giving the required definition.

In architectural work and groups greater sharpness is required than for landscapes where those parts of the pictures only which make it interesting need be absolutely sharp.

When small negatives are made, with a view to enlargement or for lantern slides, no pains should be spared to have them as sharp as the lens and subject will permit.

May 20, 1886. L. M. PETITDIDIER.

DEPARTMENT OF ZOOLOGICAL MISCELLANY.

A Call for Contributions.

All members of the Society are earnestly requested to contribute whatever of interest they may have observed or learned concerning quadrupeds, birds, reptiles, fishes, insects, or other animals.

All such articles, of sufficient novelty or importance to be printed, will appear in connection with the name of the author. Many of our members are naturalists: many are hunters, anglers, and sportsmen, and certainly ought to contribute something to these pages, and to the advancement of the Society and the growth of science. Send your articles to Wm. Hubbell Fisher, editor of this department, care of the Cincinnati Society of Natural History, No. 108 Broadway, or to Room 13 Wiggins Block, Cincinnati, O.

Mammals.

We are indebted to Mr. Amos W. Butler, of Brookville, Indiana, for the following items, as to Common Meadow Mouse and Common Mole.

Arvicola riparius—Commom Meadow Mouse.—October 11, 1886, several females were taken in my yard. Of three examined all were far advanced in pregnancy. Two contained six: one, three young. They were found frequenting some sweet potato ridges, near which was a plat of blue grass. Near the latter they were very destructive, but as the distance increased from the unbroken sod their ravages decreased. They worked lengthwise of the ridges, eating many of the potatoes. The largest tubers were selected, and all that was left of some was a thin shell with an opening into the capacious cavity the little rodents had made. It seems probable, considering the condition of the females, that these hollowed-out potatoes may have been intended as resting places.

Scalops aquaticus—Common Mole.—Observed one at work November 9, 1886. The day previous the thermometor registered 18°. November 13, one was observed at work beneath the snow. November 21,one was noticed at work.

Amos W. Butler.

Dr. F. W. Langdon, one of our most faithful and assiduous naturalists, contributes the following as to the Panther and Wolf:

Felix concolor, Linnæus,—PANTHER.—Under date of December 3, 1886, Mr. Raymond W. Smith, of Lebanon, Ohio, writes me as follows: * * * "The Journal of the first Board of Commissioners of Warren county (Ohio), shows that, at their meeting held September 15, 1803, they allowed, among others, the following bill:

"'To Timothy Squires, for killing one panther, 3 dols.' By consulting the deed record of the county for 1803, I find that Squires lived about six miles west of Lebanon, near the Shaker swamps, then very extensive and heavily wooded."

Canis lupus, Linnæus—WOLF.—The above letter also states that "on January 28, 1804, Arnold Snider and Aaron Swill were each allowed two dollars for a wolf-scalp."

F. W. LANGDON, M. D.

ORNITHOLGY.

D. J. H. Hunt, one of our former presidents, contributes the following item respecting the Martin:

CINCINNATI, Nov. 1, 1886.

W. H. Fisher, Dear Sir:—While in Tallahassee, Fla., this summer, I observed something in regard to the habits of the martins that was entirely new to me. I have never seen a martin alight upon a tree with us in the North, but invariably upon houses or the places fitted up for their especial benefit. On the main street of Tallahassee, near the St. James Hotel, was a mulberry tree that had at some time been trimmed in close, so that it had a very compact growth of limbs, forming a dense body of the top of the tree. About 4 o'clock P. M. myriads of martins would congregate there.

It so happened that at this time there was being held an Inter-State Shooting Tournament. Some of the clubs were at the hotel and saw the martins come in every day, and one evening they procured a bag and fitted a hoop in it, and one of the party, secreting himself in the tree, captured the birds in great quantities, just as an entomologist would with his net take butterflies, only that instead of capturing but a single one at a sweep, he would get from ten to twenty birds at a time, which were used next day at the fair ground for practice.

This may not be new to ornithologists, but I send it to you for the benefit, perhaps, of others.

Respectfully, DR. J. H. HUNT.

HERPETOLOGY.

The following items as to black snake, yellow-headed garter snake, pilot snake, ring-necked snake, leather snake, summer green snake, little red snake. Helen's worm snake, cave salamander, common land tortoise, lady turtle, painted turtle, brown swift, triton, are contributed by Amos W. Butler:

Bascanium constrictor, (L.) B. & G. BLACK SNAKE.—On February 10, 1886, when the ground was frozen and snow was to be found in sheltered localities, a black snake which, from the description, was probably this species, was killed near a "sink hole" on the farm of W. S. Case, four miles from Brookville. Later in theseason several other snakes of the same species were killed near the same place.

Eutænia saurita. L. YELLOW-HEADED GARTER SNAKE.—The first specimen of this species from Franklin county was taken April 26, 1886. Several have since been found. This is the most ferocious of all of our snakes. It never waits to be provoked, but hastily coils itself and strikes wickedly at the intruder. I am satisfied that this is frequently thought to be the "copperhead" (*Ancistrodon contortrix*, (L) B. & G.), a snake which is probably extinct in this county.

Coluteer absoletus, Say. PILOT SNAKE; BLUE RACER.—This is the most arboreal of all our snakes. It is frequently found at quite a distance from the ground upon large and small trees alike. A favorite position for repose appears to be upon some drooping or many-branched bush, where it may lie and enjoy the warm sunshine. They are the most destructive to birds of all our snakes. Several instances of their preference for avian food have been noticed the past summer. Some specimens have been brought to me greatly distended by the bird they had just swallowed.

Diodophis punctatus, (L.) B. & G. RING-NECKED SNAKE.—When we found the proper localities, this proved to be a rather common snake. It frequents the dry hillsides where, beneath the bark of long-fallen trees or under a stick or rotten stump, it spends the warmer parts of the day.

Tropidonatus leberis, (L.) Halb. LEATHER SNAKE.—This is regularly the earliest snake to appear in the spring and the last to

disappear in the fall. It was first noted March 22, 1885 and March 20, 1886. Mr. Edw. Hughes reports seeing one apparently very recently killed, Nov. 7, 1886: at that date the ground was frozen, and on the 5th there had been a fall of two inches of snow. This snake appears to be very irregularly distributed. It has been recorded from but two localities in Ohio, and appears to be rare in Indiana outside of the Whitewater valley, where it is common.

Cyclophis æstivus. Linn. SUMMER GREEN SNAKE.—A specimen of this species is in the collection of the Brookville Society of Natural History. It was presented by the late T. B. Ward, of Guilford, Dearborn Co., Indiana, by whom it was taken near that place. It has never been taken in this county, and this is, so far as I know, its first record in southeastern Indiana. It has but one Ohio record.

Tropidoclonium kirtlandi. Kennicott. LITTLE RED SNAKE.—Mr. C. H. Bollman informs me, upon the authority of Dr. D. S. Jordan, that specimens of this species have been taken in Monroe county, Indiana.

Carphophiops helenæ. Kennicott. HELEN'S WORM SNAKE.—Mr. Bollman has taken two specimens of this species in Monroe county.

Spelerpes longicaudus (Green) Bd. CAVE SALAMANDER.—This species, previously known from one locality, has been taken in northeastern part of the county, not far from the Ohio line.

Cistindo Carolina, (Linn.) Cope. COMMON LAND TORTOISE.—In an article on the "Hibernation of the Lower Vertebrates," in the *American Naturalist,* for January, 1885, I gave some notes from observation on this tortoise. They apparently emerge from their winter homes in this latitude late in April, or, in backward springs, early in May. I have noticed them mating as early as May 7th. Mr. E. R. Quick brought me five of six eggs taken July 16, 1886. The following are approximately the measurements in inches and hundredths, of four of them—owing to the fact that they were quite shrivelled when measured, they are not perfectly accurate:

$.95 \times 1.50$; $.85 \times 1.40$; $.85 \times 1.52$; $.87 \times 1.55$.

These eggs were almost ready to hatch. Usually these tortoises "hole up" by the middle of October at latest, but a friend found one apparently in excellent condition upon the public road November 17, 1886. Prior to this date the thermometer had twice registered as low as 18°.

Crysemys marginata. Agassiz. LADY TURTLE.—Over the most of Indiana this is the prevailing species of painted turtle, but in the Whitewater valley it is rare.

Chrysemys picta. (Herm.) Gray. PAINTED TURTLE.—This is the common species of its genus in southeastern Indiana. The watershed separating Whitewater from the White River and its tributaries marks the boundary, in a general way, between the range of this and the last mentioned species.

Sceloporus undulatus. Harlan. BROWN SWIFT. The distribution of this species in southeastern Indiana is peculiar. It is quite common in Franklin County, but generally, throughout the southeastern quarter of the State, is rare.

Desmognathus ocrophæa. Cope. TRITON. Reported common in Monroe County, Ind., by Mr. Bollman.

AMOS W. BUTLER.

FISHES.

Under this division Mr. Amos W. Butler contributes items respecting the Blind Simon, Zoned Darter, Sand Darter, White Sucker, Red-bellied Dace, Girard, Red-fin, Cope, Black-nosed Dace, Horned Dace, viz.:

Etheostoma variatum. Kirtland. BLIND SIMON. Another specimen of this rare darter was taken by E. R. Quick and the writer, September 23, 1886, in the canal, four miles north of Brookville.

Etheostoma zonale, Cope. ZONED DARTER. A few specimens were taken in the Whitewater River by members of the Indiana Academy of Science, May 21, 1886.

Etheostoma pellucida. Bd. SAND DARTER. Several specimens taken with those of the last-mentioned species.

The following species, taken by Professors W. P. Shannon and O. P. Jenkins, May 22, 1886, in Little Salt and Bull Fork, branches of Salt Creek, a tributary of the west fork of the Whitewater, have not previously been recorded from Franklin County, Indiana:

Catostomus teres. Mitchill. WHITE SUCKER.

Chrosomus erythrogaster. Rafinesque. Red bellied Dace. Scarce.

Notropis whipplei. Girard. Common.

Notropis ardens lythrurus. Jordan. Red-fin. Common.

Notropis atherinoides. Rafinesque. Rosy Minnow. One specimen.

Ericymba buccata. Cope. Common.

Rhinicchthys atronasus. Mitchill. Black-nosed Dace. Scarce.

Semotilus atromaculatus. Mitchill. Horned Dace. Scarce.

Amos W. Butler.

Brookville, Ind., *November* 29, 1886

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Frazer. The "Centennial" and "Lotta" Gold Properties.
King. Experiments with Bolts and Screw Threads.
Egleston. Treatment of Roasted Pyrites.
Clark. Lixiviation and Amalgamation Tests.
Bowron. Geology and Mineral Resources in Tennessee.
Fackenthal. The Durham Blast Furnace.
Bartlett. Manufacture of Iron in Canada.
Campbell. Open Hearth Steel.
Pierce. Self-dumping Tank.
Birkinbine. Operations of Warwick Furnace, Pa.
Garrison. Miscroscopic Structure of Car wheel Iron.
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d'Invilliers. Cornwall Iron Ore Mines, Lebanon Co., Pa.
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Boyd. Geology of Virginia and Tennessee.
Wendt. Hanging Pipe Hot-Blast Oven.
Hart. Action of Acids on Iron.
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Note.—Through a mistake of the printers an error occurs in the paging of No. 2 of this volume. It should be paged from 65 to 128, instead of 1 to 64.

THE JOURNAL

OF THE

CINCINNATI SOCIETY OF NATURAL HISTORY.

VOL. X.

1887-88.

Publishing Committee:

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THE JOURNAL
OF THE
Cincinnati Society of Natural History.

VOL. X. CINCINNATI, APRIL, 1887. No. 1.

PROCEEDINGS.

BUSINESS MEETING, *January* 4, 1887.

Mr. Wm. H. Knight, president *pro tem.* Twelve members present.

The minutes for October were approved.

Members were proposed as follows: Mr. Chas. Phipps, Mr. Chas. Harrison.

Minutes of the Executive Board for August, September, October and November were read.

The resolutions regarding communication, presented at the November meeting were laid over for discussion at a future meeting.

Dr. M. B. Ricketts read a paper on "the Relation of the size of the Red Blood corpuscles to the Weight, Size and Activity of Animals," with tables substantiating the position taken by the writer.

A paper on a "Worm-like marking found in the Shale of the Cincinnati Group, near Oxford, Ohio, by Prof. Joseph F. James, was read by the Secretary.

A letter was read from Rev. J. W. Shorten, noting the observation of a large flock of the Snow Bunting (*Plectrophanes nivalis*) near Ross, Butler County, Ohio.

Mr. Smith gave notice that circulars had been sent out announcing the organization of a Lyceum of Natural History, to hold meetings in the Society Rooms. The first meeting would be held on the 8th inst.

Mr. Knight said the course of Free Lectures would be held during the months of January, February and March, beginning on the 14th of January. He desired to say that the labor of corres-

ponding with the lecturers, and the general arrangement of the course was largely assumed by Miss Anna Brown, to whom due credit should be given.

Donations were announced as follows:

From E. M. Cooper, Proceedings of the Worcester Society of Antiquity for 1885; from Eugene A. Smith, Geological Survey of Alabama, on Warrior Coal Field; from Chief Signal Officer, Monthly Weather Review for October; from D. G. Brinton, Conception of Love in some American Languages, pamphlet; from J. E. Poorman, Jr., Specimen of Agate; from H. P. Smith, mounted Botanical specimens.

Adjourned.

SCIENTIFIC MEETING, TUESDAY, *February* 1st.

President Dun in the chair. Ten members present.

Minutes for December approved.

Dr. A. E. Heighway, Jr., exhibited some fine specimens of Staurolite from Northern Georgia, and described the locality where found.

Dr. W. A. Dun presented a series of interesting data regarding the Artesian well sunk by the Messrs. Hemingray, at their Glass works in Covington. The well is 2,007 feet deep and flows water at the temperature of 59°, estimated at 30,000 barrels and 75,000 cubic feet of gas daily. Gas was first reached at 320 feet, at 550 feet, and again at 720 feet. The bed rock was struck at 85 feet, or 43 feet below low water mark. The members present discussed the question of natural gas and the various wells sunk in the city limits.

Messrs. Chas. Harrison and Chas. Phipps were elected active members. Mr. and Mrs. Chas. A. Kebler and Dr. W. H. Wilder were proposed for membership.

Dr. Dun reported that Prof. E. D. Cope, of Philadelphia, would lecture at the Scottish Rite Cathedral on Broadway, in March, for the benefit of the Building fund of the Society. The The next lecture of the free course was announced by Mr. Knight. Prof. E. W. Claypole, of Akron, Ohio, would address the Society in College Hall, on the "Retreat of the Ice and the Evolution of Lake Erie."

Donations were announced as follows:

From E. O. Hurd, mounted specimen of Loon; from E. M. Cooper, Proceedings of Worcester Society of Antiquity, for 1884; from Dr. W. A. Dun, Symbols for weather indications; from H.

P. Smith, fixtures for displaying weather symbols; from J. S. Newberry, Bulletin of Torrey Botanical Club, January, 1887; from D. G. Brinton, Phonetic Elements in the graphic System of the Mayas and Mexicans; from Prof. W. R. Lazenby, Columbus, Ohio, Proceedings of the 7th annual meeting of Society for Promotion of Agricultural Science, President's Inaugural address, Iowa State College, 16th Annual Report of Ohio State University; from Geo. Dimmock, Cambridge, monograph on Blastonidæ and other fish-destroying Bugs; from Davis L. James, specimens of fungi, two specimens of Calymene senaria; from Bureau of Education, circular of Information on Study of Music in Public Schools; from Chief Signal Officer, Monthly Weather Review for November, 1886; from E. M. Cooper, Records of Courts of General Sessions, 1731 to 1737; from Americus Symmes, Crawfordsville Journal, January 1, 1887; from Mr. G. H. Curtis, slide of diatoms, t. v. section of hair of Texas peccary, diaphragm for microscope.

Adjourned.

SCIENTIFIC MEETING, *March* 1st.

President Dun presided. Twenty members present.

The minutes for February were approved.

Mr. W. H. Knight read an interesting sketch of the life of Wm. Wagner, the founder of the Wagner Free Institute of Science in Philadelphia.

Mr. Wm. Hubbell Fisher presented some Zoological notes, viz.: Note on the occurrence of the Rough-legged Buzzard Hawk in Hamilton County. Note on Snow Buntings, by J. W. Shorten, and an entertaining account of a Tame Crow.

The Secretary presented and read by title a paper by Prof. A. P. Morgan on "the Mycologic Flora of the Miami Valley, including the Hydnei." The secretary said that Mr. Morgan's papers on Mycology were of the utmost value to students. They placed within reach of all the scattered descriptions of these rare and interesting plants. The Society was especially favored by Mr. Morgan in having the honor of printing this series of researches into the Fungi of our vicinity.

By request Mr. Geo. H. Curtis read a description of a shower of mud which he regarded as Volcanic, which fell during the heavy wind storm of the night of February 24th, on Mt. Adams. He

also showed under the microscope a slide prepared by himsel ffrom the dust, and presented one to the Society.

Dr. W. A. Dun said he would make a few announcements:

First—Prof. Cope would lecture twice in the city, on Sunday, March 20, in the Unity Club Course, and on Tuesday, March 22, in the Scottish-Rite Cathedral on Broadway. The subject for the latter lecture would be "The Origin of Man and other Mammalia."

Second—The Photographic Section would show on Thursday evening, March 3d, the 100 slides received in exchange from the Amateur Photographers of St. Louis.

Third—The exhibit of Foreign slides for the benefit of the Building Fund would take place on April 8th in the Odeon.

Dr. Dun in presenting a specimen of Mound Builders cloth read the following letter from Dr. N. E. Jones, of Circleville, O.:

CIRCLEVILLE, OHIO, *February* 25, 1887.

DR. W. A. DUN, Cincinnati, O.

My Dear Doctor:—Thank you for your kind letter of the 21st. The specimen of mound builders' cloth is yours and your disposal. It was taken August, 1884, from the most beautiful and best preserved monument of the mound builders found anywhere in Southern Ohio.

This mound is situated near the Scioto river on an elevated plateau, six miles south of the City of Circleville, Ohio. It is not circular but has a base of 50×80 feet in diameter and a perpendicular height of eighteen feet with a flattened top 25×40 feet. The top is covered with a blue-grass sod while the base and sides are thickly studded with small forest trees of various kinds. There is a singular fact connected with the mound—from the first discovery to the present time no shrub nor tree has ever attempted to grow upon the sumit; and the excavation showed none had ever been there. In making this partial excavation, the earth was removed from the base towards the center—before reaching the center and above the basal line, an altar was unearthed formed of bricks and mortar, made as smooth as a billiard table and upon which rested charcoal or pieces of wood charred, from one to six inches in diameter, forming a bed or mass of charcoal eight feet square and over twelve inches thick (or deep). On this charcoal was resting the winding sheet, showing every fold and seam and thread just as it covered the human form. This wrap occupied the space due a

large corpse and inclosed many charred bones of a human being. There were three wraps inclosing the remains, all differing in fineness of texture but woven in the same way. Each of these wraps could be removed separately and in pieces of several yards in length and breadth. In this wrap was also a stone, the upper side highly polished, the lower side, or that resting on the charcoal is burned and roughened and has the appearance of blood burned and adhering. The thickness of this stone is one-fourth of an inch in every part. The holes are larger on the burned side and small on the other.

This is an interesting mound and has not yet been opened sufficiently to know much about it. I wrote to several societies and sent them specimens, asking assistance to make a thorough excavation with drawings etc. Received promises but nothing more. Believe the one discovered is only one of a series of altars or furnaces of cremation that may be found.

Yours most Respectfully,

N. E. JONES.

Dr. Dun as per announcement then made a few remarks on the depth of the drift about Cincinnati, and showed a section of one of the three wells drilled at Ivorydale by Proctor & Gamble.

The remarks were followed a few words by Dr. O. D. Norton on the water supply of Cincinnati, and by Mr. M. D. Burke; Mr. Burke said that in surveying between the Miami's about Lebanon, he was surprised to find an almost level grade between the rivers.

Names were proposed for membership as follows:

By the Executive Board, for corresponding members:

Erasmus Gest, New York City; Stephen D. Peet, Clinton, Iowa; O. P. Hay, Irvington, Indiana; for honorary member, Prof. E. W. Claypole, Akron, Ohio, and by various members, for active membership as follows:

Dr. A. L. McCormick, R. S. Fulton, W. D. Holmes, Mrs. W. D. Holmes, E. T. Mosier, Jerome R. Clark, W. F. Gray, D. B. Gamble, J. K. Martin, Mrs. Thos. Emery, Mrs. Herbert Jenney, Chas. T. Greve.

Mr. and Mrs. Chas. A. Kebler and Dr. W. H. Wilder were elected members.

Mr. J. Kelly O'Neall, of Lebanon, Ohio, presented through the secretary the following preamble and resolutions:

"WHEREAS, the real estate embracing the ancient work known as 'The Old Fort' situated near Fort Ancient in Warern county is for sale, and

"WHEREAS, It is desirable that said 'Old Fort' be preserved as a specimen of the civilization and engineering skill of the ancient inhabitants of Ohio, and,

"WHEREAS, said 'Old Fort' is now largely occupied as farm land and is being rapidly obliterated and destroyed, and under existing circumstances must soon cease to be the Archeological monument it now is, therefore

"*Resolved*, That the Legislature of Ohio be and hereby is respectfully requested to acquire by purchase or otherwise said property embracing said 'Old Fort' and its accessories and dedicate the same as a public park, or to any other purpose consistent with, and which will conduce to the preservation of said ancient earth work as an unequalled specimen of the Mound Builders' power and skill.

Resolved, that a copy of this resolution, and the preambles be sent to the Lieutenant Governor and the speaker of the House of Representatives, who are requested to lay them before their respective bodies."

After some conversation regarding the importance of preserving not only this but other ancient remains in the State, the resolutions were unanimously adopted.

The Society after the reading of donations adjourned.

Donations were as follows:

From Chas. Faber, specimens of crustacea of Cincinnati Group; from Dr. A. E. Heighway, Jr., Crystals of Staurolite from Georgia; from Dr. N. E. Jones, Circleville, specimen of Mound Builders' cloth; from D. S. Schureman, slide of volcanic ashes; from Chief Signal Officer, Monthly Weather Review for December, 1886; from Dr. O. D. Norton, Smithsonian Report for 1872; from H. C. Fithian, Ohio Agricultural reports for 1882 and 1883; from E. M. Cooper, miscellaneous pamphlets and scientific journals; from Jos. F. James, Journal of Science, December, 1879, February, 1880, Random Notes, Vol. I. No. 5, Conchologists' Exchange, Vol. I. No. 2.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY, OHIO.

By A. P. Morgan.

(Read by Title, March 1, 1887.)

Continued from Vol. IX., p. 8.

Class I.—Hymenomycetes.

Order III.—Hydnei.

Hymenium inferior or amphigenous, effigurate from the first and definitely but variously protuberant into aculei, teeth, tubercles, crests and papillæ.

By far the greater part of the species are resupinate-effused.

TABLE OF GENERA OF HYDNEI.

A. Hymenium aculeate or dentate.

1. Hydnum. Aculei subulate, discrete at the base.
2. Irpex. Teeth acute, joined together at the base.

B. Hymenium tuberculate, wrinkled, etc.

3. Radulum. Hymenium of rude, deformed, obtuse tubercles.
4. Phlebia. Hymenium in crowded folds and wrinkles.
5. Grandinia. Hymenium granulose, the granules globose or hemispheric.
6. Odontia. Hymenium of warts penicillate multifid at the apex.
7. Kneiffia. Hymenium strigose-exasperate with rigid setæ.

Genus I.—Hydnum, Linn.

Hymenium inferior, aculeate ; aculei subulate, discrete at the base.

* *Pileus stipitate.*

I. Mesopus. Stipe central.
  a. Pileus fleshy, 1–3.
  b. Pileus coriaceous, 4.

II. Pleuropus. Stipe lateral, 5.

III. Merisma. Much branched, 6–8.

*** Stipe wanting.*

IV. Apus. Pileus sessile.

c. Pileus fleshy, 9–11.

d. Pileus coriaceous, 12–14.

V. Resupinati.. Pileus none.

e. Subiculum thick, fleshy, 15.

f. Subiculum waxy, 16, 17.

g. Subiculum membranaceous, 18–24.

h. Subiculum crustaceous, 25-30.

I. Mesopus. Pileus entire, simple, the stipe central.

All the species are terrestrial and grow chiefly in pine woods; this will account for their scarcity in the Miami Valley which is notable for the absence of evergreen woods.

a. Pileus fleshy.

1. H. infundibulum, Sow. Pileus fleshy-fibrous, tough, infundibuliform, unequal, even, brown. Stipe unequal, pallid, with a tapering base. Aculei decurrent, white, then bay.

In woods, rare. Pileus 4–6 inches in diameter, the stipe 2-3 inches in length and an inch thick.

2. H. repandum, Linn. Pileus fleshy, fragile, more or less repand, nearly glabrous, pallid. Stipe deformed, pallid. Aculei unequal, concolorous.

In rich woods, common Pileus 3–5 inches broad, stipe 3–4 inches long The pileus is sometimes floccose-pruinose; the color varies from whitish to yellowish or a fleshy tinge, but it is unchangeable.

8. H. diffractum, Berk. Pileus fleshy-tough, thick, glabrous, alutaceous. Stipe obese, alutaceous. Aculei equal, pale alutaceous.

In dry woods, rare. Pileus about 3 inches broad, the stipe 2 inches in height. The pileus and stipe are of a tough, fleshy substances, and at length becomes much cracked and split. A remarkably rigid species when dry.

b. Pileus coriaceous.

4. H. zonatum, Batsch. Ferruginous. Pileus equally coriaceous, thin, expanded, more or less infundibuliform, zonate, becoming glabrous, radiate-rugose; the margin paler and sterile underneath. Stipe slender, nearly equal, floccose, with a tuberous base. Aculei slender, pale, then ferruginous.

In oak woods, rare. Pileus 1–2 inches broad, the stipe less than an inch in length.

II. PLEUROPUS. Pileus more or less dimidiate, the stipe lateral.

5. H. ADUSTUM, Schw. Pileus variable in shape from orbicular and entire to dimidiate and reniform, coriaceous-tough, whitish or pale yellowish. Stipe ascending, unequal, subcentral or lateral. Aculei at first pallid or yellowish, then changing to brown or blackish.

In woods on fallen sticks and branches, not rare. Pileus 2–3 inches broad, the stipe an inch or less in length. The pileus in very thin, velvety or nearly smooth, more or less zonate, sometimes brown-zonate. The stipes are sometimes concresent, with separate or more or less united lobed and overlapping pilei.

III. MERISMA. Very much branched or tuberculiform and immarginate.

6. H. CORALLOIDES, Scop. Very much branched, pure white; finally changing to yellowish and the whole plant expanding into attenuate intricate branches. Aculei unilateral, subulate, entire.

In woods on old trunks, common. A very showy plant, sometimes a foot or more in extent, when fully developed consisting of numerous intricate branches with the spines pendent from the lower sides. It is said to be edible.

7. H. ERINACEUS, Bull. Fleshy, elastic-tough, pendulous, tuberculose, immarginate, white, changing to yellowish, fibrillose, lacerate above. Aculei very long, straight, equal, pendulous.

In woods on old trunks, not rare. Of a rounded form 4–8 inches in diameter, sometimes with the rudiment of a lateral stipe; appearing solid but when broken open it is found to be a mass of interlacing branches. The spines are remarkably long, from 1–2 inches or more.

8. H. STRATOSUM, Berk. Pilei resupinate, with a narrow lobed border, consisting of repeatedly branched rigid brown processes, which are clothed above with gray or ferruginous tow-like fibers. Aculei rather long, rigid, sharply acuminate, brown varying to cinereous, at length stratose.

On a dead trunk (*Lea*). Pilei spreading for 3 or 4 inches over the matrix. "This is one of the most remarkable species with which I am acquainted." "I do not know any other species with which it can be compared." (*Berkeley* in Lea's Catalogue.) This appear

to be a rather doubtful production; there is no record of its ever having been found again, and Mr. Berkeley does not enumerate it in the Notices of N. A. Fungi. I have never met with anything that would answer to it in any way.

IV. Apus. Pileus sessile, dimidiate, marginate, often effuso-reflexed.

c. Pileus fleshy.

9. H. CIRRHATUM, Pers. Pileus fleshy, expanded, pallid, cirrhate-fibrillose above with scattered decumbent abortive aculei; the margin fimbriate, incurved. Aculei very long, a little tough, equal.

In woods on old trunks, rare. Simple or imbricated, the single pilei somewhat reniform and 1–2 inches in breadth; the spines half an inch or more in length. It varies in color, being white, yellowish and rufescent.

10. H. PULCHERRIMUM, B. and C. Pileus fleshy fibrous, alutaceous, hirsute; the margin thin, entire, incurved. Aculei short, crowded, equal.

In woods on old trunks, common. Imbricated and laterally confluent, the single pilei 2–4 inches in breadth and projecting 2–3 inches. The color varies from white through alutaceous to yellowish; the texture is fibrous with a fibrous-hirsute surface; sometimes there is a faint zonate arrangement of the fibers of the surface. The spines scarcely exceed a quarter of an inch in length; they take on a rufescent hue in drying

11. H. SEPTENTRIONALE, Fr. Fleshy-fibrous, tough, pallid. Pilei innumerable, plane, scalariform, connate behind into a thick solid body, the margin straight, entire. Aculei crowded, slender, equal.

In woods on standing trunks, rare. The masses of pilei arranged one above another and fused together behind are sometimes a yard or more in extent; the single pilei are 2–6 inches in breadth and project 3 inches or more, the spines are about half an inch in length. This magnificent Hydnum "the largest of the genus," grows even more luxuriantly with us than in Sweden.

d. Pileus coriaceous.

12. H. GLABRESCENS, B. and Rav. Pilei effuso-reflexed, coriaceous, thin, velvety then glabrate, concentrically sulcate, brownish; the margin even. Aculei crowded, long, slender, rufous.

In woods on trunks and branches, common. Pilei imbricated and confluent sometimes to the extent of several inches, the single pilei 1–3 inches in width and projecting an inch or more. The color is a pale or dark brown, drying to brownish alutaceous; when fresh it has a pleasant fragrance. The spines are longer than the thickness of the pileus and yet scarcely reach an eighth of an inch, they are somewhat compressed and are nearly obsolete around the margin.

13. H. FLABELLIFORME, Berk. Pilei sessile, spathulate flabilliform, laterally confluent, coriaceous, tawny, hirsute, concentrically sulcate. Aculei crowded, very long, ochraceous flesh-color.

In woods on trunks and branches, common. The pilei are attached by a narrow base or sometimes substipitate, not effuso-reflexed as in the preceding and the following species; they are often laterally confluent above and separate at the base, an inch or thereabouts in length, concentrically sulcate or subzonate and longitudinally crisped and wrinkled. The spines are twice as long as the thickness of the pileus.

14 H. OCHRACEUS, Pers. Pilei effuso-reflexed, coriaceous, thin, zonate, ochraceous. Aculei very small, ochraceous flesh-color.

In woods on fallen sticks and branches, common. Usually largely resupinate with a long and narrow reflexed margin not half an inch in width; often it occurs wholly resupinate, it then has a narrow, pale, thick tomentose border.

V. RESUPINATI. Pileus none. Fungi absolutely resupinate, the aculei straight or oblique according to the situation.

e. Subiculum thick, fleshy.

15. H. CASEARIUM, Morg. Subiculum fleshy-cheesy, thick, extensivly effused, white. Aculei waxy, crowded very long, subulate, terete, whitish then pale alutaceous.

On the lower side of an old hickory trunk. Effused for several feet, the subiculum nearly half an inch in thickness, contracting in drying and becoming hard and rimose. The aculei are 2–4 lines long, oblique, more or less fused together below.

f. Subiculum waxy or subgelatinous.

16 H. XANTHUM, B. and C. Subiculum effused, at first white and tomentose, then waxy. Aculei distant, compressed, sometimes divided, lemon-yellow.

On hard wood in damp places. Effused for an inch or two. The aculei are often cleft, the tips when fully developed are white and tomentose

17. H. UDUM, Fr. Subiculum effused, thin, somewhat gelatinous, agglutinate, glabrous, flesh-color then watery-yellowish. Aculei close, unequal, forked and fimbriate, concolorous.

On rotten wood of Elm. Very extensively effused sometimes for many feet. The aculei very unequal and more or less fused together and the waxy, uneven subiculum remind one of Radulum. Different patches of flesh-color and yellowish are usually to be seen at the same time in the same specimen. The dried specimens take on a brownish hue.

g. Subiculum byssine or membranaceous.

18. H. OHIENSE, Berk. Subiculum effused, membranaceous, separable, pale yellow. Aculei somewhat fasciculate, long, very acute, of a watery pale brown.

On rotten trunks and branches. Effused for several inches, membranaceous and partially separable from the matrix. The aculei are 1–2 lines long and very slender at the apex.

19. H. BYSSINUM, Schw. Subiculum byssine, very thin, pulverulent, somewhat evanescent, ochraceous then bay; the border fibrillose. Aculei long, distant, subflexuous, very acute, concolorous.

On rotten wood. It is not circumscribed by a regular border, but fibrils radiate irregularly from the edge of the subiculum. The aculei from a thick base elongate to a very sharp point.

20. H. ALBOVIRIDE, Morg. Subiculum membranaceous fibrillose, creeping extensively, white. Aculei crowded, very long, subulate, terete, entire, olivaceous.

On the underside of old logs. The white filmy subiculum runs over the wood and bark and over the leaves and sticks beneath; here and there are olive colored cushions of spines an inch or more in extent, leaving large white naked spaces. The aculei are 2–3 lines long and taper gradually to a fine point; they are darker after drying.

21. H. PITHYOPHILUM, B. and C. Subiculum effused, byssoid, very thin, farinaceous. Aculei compressed, ochraceous, denticulate or divided at the apex.

On dead wood. Effused in small patches. The teeth are rather crowded on the thin subiculum; on the surface of them are minute granules.

22. H. ISCHNODES, Berk. Subiculum membranaceous-fibrillose, creeping extensively, white. Aculei scattered, distant, subulate, slender, becoming darker.

On wood and bark of Juglans. The subiculum is composed of a thin membrane of interwoven threads with thicker branched fibrils beneath. The aculei occur in patches with abundant naked space; in places there are only the thick fibers creeping over the matrix. This is an elegant resupinate species, its color all white when fresh.

23. H. FALLAX, Fr. Subiculum irregularly effused, thin, villose-furfuraceous, white. Aculei close, deformed, incised, yellowish or whitish.

On the underside of old Oak logs. Irregularly effused even for several feet, mostly white but yellowish here and there in spots and patches. The aculei are short minute and quite irregular.

24. H. MUCIDUM, Fr. Subiculum very broad, membranaceous, soft, separable, white, the margin and underside villous. Aculei close, long, acicular, slender, flaccid, equal, concolorous.

Upon very rotton wood. The subiculum, a long and wide membrane, soft and tomentose beneath, and sometimes yellowish. The aculei are 2-4 lines or more in length, terete and tapering to a fine point.

h. Subiculum crustaceous or farinaceous.

25. H. FUSCO-ATRUM, Fr. Subiculum crustaceous, thin, at first glaucous, flocculose, pruinose; afterward glabrous, ferruginous, fuscous. Aculei short, conic-subulate, acute, cervine, then blackish.

On rotten wood of Beech. In its younger state, somewhat orbicular ½-1 inch broad, the margin often byssine; afterward becoming confluent and broadly effused. Aculei rather short and not much crowded.

26. H. ALUTACEUM, Fr. Subiculum longitudinally effused, crustose, adnate, glabrous, pale ochraceous, the border naked. Aculei minute, close, equal, acute.

On bark and wood of Beech and Maple. Effused for several inches, and separate from but closely adnate to the matrix. The aculei are very minute and close, and grow out to the very edge of the subiculum.

27. H. NYSSÆ, B. and C Subiculum effused, copiously pulverulent, alutaceous, Aculei long, crowded, subulate, acute, often pencilled at the tip, concolorous.

On wood and bark. Effused for several inches with scarcely any border. The aculei are pubescent, with some long hairs at the apex.

28. H. FARINACEUM Pers. Subiculum effused, indeterminate, mealy-crustaceous, white; the border more or less flocculose. Aculei slender, rather distant, very acute, entire, concolorous.

On old Beech bark. Effused for an inch or more. The subiculum is a very thin, white, mealy stratum, closely adnate to the matrix. The aculei are minute, sharp pointed and not crowded.

29. H. NUDUM, B. and C. Subiculum innate or nearly obsolete, farinaceous, pale ochraceous. Aculei minute, short, distant, subulate, concolorous.

On wood and the inner bark of Sugar Maple. The subiculum is nearly the color of the wood, and the aculei in some places seem to be growing on the wood; but there is usually a tinge of color to indicate the presence of the subiculum, though the fibers of the wood may be quite distinct.

30. H. SUBTILE, Fr. Subiculum very tender, innate in spots, glabrous, watery, whitish. Aculei distant, acute or incised, concolorous.

On bark and wood. Subiculum indeterminate, evanescent, whitish, somewhat hyaline. Aculei very short, minute, falling away to the touch.

Genus II.—IRPEX, Fr.

Hymenium inferior, dentate; the teeth seriately or reticulately arranged, and connected together at the base by folds, which are lamellate or porose. Fungi lignatile.

I. APUS. Pileus sessile or effuso-reflexed, marginate.

1. I. CRASSUS, B. and C. Pilei thick, corky, white, finely pubescent, effuso-reflexed behind, and laterally concrescent. Teeth lamellately arranged, compressed, unequal in length, concolorous.

In woods upon trunks, not rare. I have seen it growing on a standing trunk in an elongated mass of imbricated pilei several feet in extent, after the manner of *Hydnum septentrionale*. The single pilei are 1½ to 2½ inches in width, and project an inch or two. The lamellate arrangement of the teeth is very plain, those next the margin are short, broad and flat, those farther behind are very long and narrow, a half inch or more in length. This is one of the most elegant species of this genus.

2. I. LACTEUS, Fr. Pileus effuso-reflexed, coraiceous, villous, concentrically sulcate, white, teeth close, seriately arranged, acute, more or less incised, white.

On trunks of Oak, rare. Pileus, nearly an inch in width and projecting about half an inch, but the pilei are usually more or less confluent. The teeth are short, denticulate, and often with a concentric rather than a lamellate arrangement.

3. I. TULIPIFERÆ, Schw. Pileus very extensively effused, shortly reflexed, villous, azonate, white. Teeth porose, connected at the base, irregular, denticulate and incised, white.

On trunks and branches of Liriodendron, Hickory, etc., very common. By far the greater part resupinate, with a long and narrow reflexed margin, often on both edges. It remains a long time porose, the dentate dissepiments finally lengthen into flat irregular teeth. It was first described by Fries as a Polyporus, and this is what it should have been allowed to remain.

II. RESUPINATI. Pileus none; wholly resupinate.

4. I. FUSCESCENS, Schw. Coriaceous membranaceous, olivaceous then cervine, at first orbicular, then confluent and extensively effused, with a narrow fimbriate border. Teeth irregular, unequal, compressed, setulose, cervine.

On dry Oak branches; very common. Effused along the under side of a branch sometimes for several feet. The hymenium is sinuose-plicate, the folds broken into very unequal and irregular teeth, varying from narrow and pointed to broad, flat, and even sinuous; it is invested with minute brownish bristles; these are the "ascis prominulis fuscis", of Schweinitz's description; they are of the same nature as those which occur in some species of Stereum (Hymenochæte). Old weathered specimens became cinnamon or brownish, and these are said to be *I. cinnamomeous*, Fr.

5. I. LACTICOLOR, B. and C. Membranaceous, separable, widely effused, the border byssine, white. Teeth compressed, dentate and lacerate at the apex, seriately arranged, reddish ochraceous.

On dry Elm branches, rare. Effused for several inches on the under side, and more or less separable, with a white subiculum and a white byssine margin. The teeth are thin, flat, and coriaceous, and it seems to me best recognized as an Irpex. It is *Hydnum lacticolor*, B. and C.

6. I. OBLIQUUS, Schrad. Effused, crustose, adnate, white,

becoming pallid; the border byssine. Teeth arising from a porous base, compressed, unequal, incised, oblique.

Upon the bark of various trees, rare. Subiculum thin, closely adnate, at first porose, but the dissepiments then dentate; at length the teeth become altogether Hydnoid.

Genus III.—Radulum, Fr.

Hymenium amphigenous, tuberculose; tubercles rude, deformed, commonly elongated, obtuse, waxy, discrete, with no regular arrangement.

1. R. pallidum, B. and C. At first orbicular, then confluent and effused, with a narrow reflexed tomentose margin, pallid. Tubercles terete, short, deformed, scattered or sometimes collected in lines or groups.

On the smooth bark of branches of Oak, Hickory, etc. The upper reflexed margin is usually very narrow but sometimes it projects as much as a quarter of an inch; on the lower side there is commonly a fimbriate border, through sometimes it is reflexed also.

2. R. orbiculare, Fr. *In autumn*, orbicular, confluent, white then yellowish, the border byssine; tubercles elongated, nearly terete, scattered or fasciculate. *In spring*, waxy, glabrous flesh color; tubercles softer and shorter as if worn off.

On dead trunks and branches of Carpinus. Effused, often for several feet, in a thick waxy stratum, presenting various inqua'-ities of surface in the shape of warts, granules, tubercles, etc. It is scarcely typical on this matrix, but then Fries says of this species that of all resupinate fungi it is the most variable in form.

3. R. molare, Pers. Widely effused, crustaceous, glabrous, pale wood color, becoming a little yellowish. Tubercles deformed, short, conic, glabrous, scattered or confluent in groups.

On old trunks of Elm, Hickory, etc. Effused for several feet in a thick waxy stratum, which, when dry is hard and crustaceous, the color is alutaceous or pale ochraceous.

Genus IV.—Phlebia, Fr.

Hymenium inferior or amphigenous, soft, waxy, glabrous, contiguous, from the first raised into wrinkles and crests, the wrinkles crowded, interrupted, persistent, the edge entire.

1. P. pileata, Peck. Pilei coriaceous, effuso reflexed, zonate, subtomentose, purplish-brown. Hymenium brownish, stained with red or orange, the folds crowded and radiating.

On a hard, dry Ash log. Pilei more or less imbricated, and laterally confluent, projecting half an inch in my specimens, the folds frequently interrupted behind, and appearing like coarse papillæ, when dry suffused with a dull tawny bloom.

2. P. MERISMOIDES, Fr. Effused, flesh-colored, then livid, villous and white on the under side, the border orange, strigose. Wrinkles simple, straight, crowded.

On stumps and trunks commonly incrusting mosses, but also investing the rough bark, common. In incrusting the mosses out growths proceed from the surface as well as the margin. Effused in patches sometimes several inches in extent.

3. P. RADIATA, Fr. Subrotund, equal, glabrous on both sides, fleshy-red, the border radiate-dentate. Folds straight, seriately radiating.

On smooth bark and wood; common. Though originating in circular patches with the wrinkles radiating from the center, these patches soon become confluent often to the extent of a foot or more. This species is thinner than the preceding, is lighter colored, and is not villous next to the matrix. *P. cinnabarina*, Schw. does not appear to differ otherwise than in the color.

Genus V.—GRANDINIA, Fr.

Hymenium amphigenous, contiguous, waxy, papillose-warty or rather granulose. Granules globose or hemispheric, entire, obtuse, close, regular, glabrous, persistent.

1. G. MUCIDA, Fr. Waxy-mucid, effused, subinnate, reddish-yellow; the border determinate, somewhat radiating. Hymenium contiguous; granules close, rather large, unequal, hemispheric, soft.

On wood and bark of Beech, Elm, etc.; not rare. In an early stage subrotund, but soon widely confluent.

Genus VI.—ODONTIA, Fr.

Hymenium composed of interwoven fibers, which coalesce into papillose or aculeate warts, cristate-multifid or penicillate at the apex.

1. O. FIMBRIATA, Pers. Effused, membranaceous, seceding, pallid, traversed by root-like fibers; the border fibrillose-fimbriate. Warts minute, in the form of granules, multified at the the apex, rufescent.

On the underside of old trunks and branches lying on the ground; common. Effused for several inches or a foot or more. This is an elegant resupinate fungus. The thick root-like fibers run beneath and support the thin membrane, sometimes they run out free over the matrix. The "incarnate-rufous" color of the original description answers best to my specimens.

2. O. HYDNOIDEA, Schw. Widely effused, thick, fibrillose, subpulverulent, at length, hard as if corky, tawny-rufous. Warts aculeate, connate, fimbriate-fibrillose at the apex, concolorous.

On very rotten wood. Effused for several feet over the crumbling matrix. The substance at first is brittle and pulverulent but becomes quite hard and corky when dry; it has the "brick color" within and upon the matrix as observed in *O. lateritia*, B. and C. The hymenium appears as if composed of hydnoid teeth fused together nearly to the apex often in groups; it becomes a little darker than the substance in drying.

Genus VII.—KNEIFFIA, Fr.

Hymenium amphigenous, contiguous, united but incomplete, similar, strigose-exasperate with rigid setæ which are scattered or fasciculate.

1. K. CANDIDISSIMA, B. and C. Regularly effused, agglutinate, thin, white, the border similar. Hymenium becoming covered with numerous granules which are apiculate with rigid setæ.

On the underside of twigs and branches; rare. At first forming a thin pure white stratum, looking like a Corticium, at length thickening and sprinkled with numerous granules. Occasionally it acquires a slight ochraceous tinge.

BISON LATIFRONS—LEIDY.

By Horace P. Smith,
Custodian Cincinnati Society of Natural History.

(Read December 7, 1886.)

Plate I.

Fossil remains of extinct species of ox have been found quite generally distributed throughout the United States, and accounts of these have been published as far back as the year 1803. These remains has been fragmentary and though quite numerous, their character has been such that the identification of species has been attended with much difficulty and confusion.

It is due to the earnest labors of Dr. Leidy that order has been brought about and questions of identity in most cases decided. In the Philosophical Magazine for 1803, Mr. Rembrandt Peale announced the first distinct species of fossil extinct American ox, to which he gave the name Great Indian Buffalo.

This species was established upon a fragment of cranium with a portion of the horn core attached, found in the bed of a creek emptying into the Ohio twelve or fourteen miles above Big Bone Lick, Ky.

This fragment was presented to the Philosophical Society by Dr. Samuel Brown, of Kentucky, and is now deposited in the museum of the Academy of Natural Sciences, Philadelphia.

A cast of the specimen was sent to Cuvier, who considered it as belonging to the same species as *Aurochs*, and is so described by him in the Annals of the Museum of Paris. Dr. Harlan afterwards gave it the name *Bos latifrons*, or broad-headed ox. At the meeting of the Academy of Natural Sciences, July 6, 1852, Dr. Leidy called attention to this fragment, which he considered as belonging to a species of bison and gave it the name Bison latifrons.*

It was upon this specimen that the species was first established by Dr. Leidy, and since, numerous fragments which had been described by various authors, under as many different names, have been referred to this species, which were the largest of our extinct American oxen.†

The following measurements are given by Dr. Leidy in his description of this specimen in "Memoir on Extinct Species of

*Proc. Ac. Nat. Sc. 1852, 117.

†Jour. Ac. Nat. Sc. vol. vii Ser. ii p. 372.

American Ox," published in Smithsonian Contributions to Knowledge, Vol. V, part III.

Breadth of forehead between bases of horn cores..	15	inches.
Circumference of horn cores at base..............	$20\frac{1}{2}$	"
" " 10 inches from base...............	$17\frac{1}{2}$	"

Considering the two generic names used in connection with this specimen Bison latifrons, Leidy, and Bos latifrons, Harlan, it may be well to state the characteristics of the two genera.

The genus Bison is thus defined by Hodgson: "Skull less massive than in Bos or Bibos, facial portion longer and more finely tapering. Superior portion of forehead transversely arched, intercornual space centrally elevated, viewed anteriorly this portion is a truncated cone, posterior aspect of skull is triangular. more extensive tnan in Bos but greatly less so in Bibos.

Horn cores of Bison subcylindrical, upper border is concave.

Of the genus Bos, Lydekker says: The superior border of horn cores is at first convex. In typical species the intercornual space is straight and the horn cores are cylindrical, in some aberrant varieties the horn cores are compressed, and the intercornual space is somewhat arcuated.†

It is with special reference to the fossil remains of the species Bison latifrons which are deposited in the Museum of the Cincinnati Society of Natural History, that this paper is written. These remains consist of a pair of fossil horn cores in a very perfect state of preservation, and indicating an ox of mammoth size.* The cores were found in 1869, on Brush Creek, Brown Co., Ohio, while excavating tor the piers of a bridge. They lay about 18 feet below the surface, in the Drift deposit which in Brown Co., lies immediately upon the Cincinnati group of the Lower Silurian. The cores were brought to Cincinnati, and for a time were the property of a German citizen living in the northern part of the city. They were incidentally brought to the notice of Dr. O. D. Norton, to whom they were loaned for exhibition before the Cincinnati Society of Natural History, when the Society had rooms in the College Building on Walnut Street. Great interest was awakened concerning these rare specimens, not only among our home scientists, but among all to whom they became known. This was about the year 1874, and during that year an article from the pen of Dr. Norton with regard to these cores was published in the Cincinnati Gazette.

*The writer is indebted to Mr. A. J. Carson for an excellent photograph of these specimens.

†Geol Sur. India, Pal. Ind., Ser. X. vol. i pt. 3.

The cores were returned to their owners and were purchased from him for the collection of the Society through the negotiations of Dr. Norton, to whom the Society owes a debt of gratitude for securing these very valuable specimens for the Society Museum. The money for their purchase was raised by subscription among a few of the members.

The following measurements show them to be almost equal in size to the specimens upon which the species was established:

Length of right core	2 feet	8	inches.
" " left "	2 "	7	"
Width of Forehead,	1 "	4	"
Entire length of curvature,	6 "	8	"
Spread of horns from tip to tip,	6 "	1	"
Circumference at base,		20½	"
" 10 inches from base,		16	"

Casts were prepared for purposes of exchange, one pair of which remains.

As a matter of interest and for purposes of comparison, I wish to notice a few other specimens of this species which have, from time to time, been described.

In "Contributions to Extinct Vertebrate Fauna," Leidy, vol. 1 p. 253, Dr. Leidy describes a specimen which he refers to Bison latifrons found by Calvin Brown and son Wilfred, of San Francisco, in a bed of blue clay 21 feet below the surface in Pilarcetos Valley, Cal. The following measurements of this specimen and of the Bison americanus are given.

	B. latifrous	B. Americanus.
Distance between tips of horn cores,	36 inches	26 inches.
" " bases of " "	15½ "	12 "
Circumference at base,	14 "	11 "
Length along lower curvature,	14½ "	12 "

A fragment of fossil cranium with horn cores attached, described by Dr. Carpenter, has also been identified with Bison latifrons; it measures as follows:

Circumference at base of horn core,	17 inches.
" 18 inches from base,	14 "
From one broken extremity to the other of the cores	56 "
Width of frontal bone between the cores,	14 "

During the excavation of the Brunswick Canal, near Darien, Ga., fossil remains of extinct mammals were found in considerable abundance. These specimens were sent to the Academy of Natural Science, Philadelphia, and announced at the meeting of July 12, 1842.

In a communication concerning them, Mr. Couper made the following statements:

They were found in the bed of the canal, at six different points, at the bottom of the alluvial deposit, imbedded in it, and resting on the stratum of sand below. Marine shells were found in a stratum of coarse sand, lying a few feet below the strata mentioned above, indicating that the country here had once been covered by the sea, and was raised by a subsequent upheaval.

The remains of mammals occured generally in groups, and all were found at the same depth imbedded in the same stratum. The bones of the Megatherium and Mammoth were found to be most abundant. This fact is taken as evidence of the co-existence of the Megatherium, Mastodon, Mammoth, Hippopotamus, Horse, Ox and Hog, at a period succeeding the elevation from the ocean of the newer Pliocine, and the co-existance of these mammals was believed to have been proved at this place for the first time.*

Among these specimens was a fossil bone which Dr. Harlan afterwards described as belonging to a new species which he called Sus americana. To this specimen Owen afterwards gave the generic name Harlanus, believing it to be a tapiroid pachyderm.

At a meeting of the Academy, June 6, 1854, Leidy stated with regard to the above that *Sus Americanus*, Harlan and Harlanus, Owen, was probably a true ruminant, and identified it with Bison latifrons. The fragment in question was that of a lower jaw, and the conclusions of Leidy were based on the form of the fragment and the characteristics of the molars.

Remains of fossil species of ox which have been identified with Bison latifrons, have been described at various times and under the following names: *Great Indian Buffalo*, Peale; *Aurochs*, Cuvier; *Bos latifrons*, Harlan; *Urus*, Bojanus; *Great Fossil Ox*, sp. *Catifrons*, Godman; *Bos urus*, Buckland; *Taurus latifrons*, *Taurus*, Rafinesque; *Bison priscus*, *Bos priscus*, Meyer; *Bos*, *Bison or Ox*, Harlan; *Fossil Ox*, Perkins; *Sus americana*, Harlan; *Sus americanus*, Pictet; *Lophidore bathygnathus*, *Harlanus americanus*, Owen; *Bison latifrons*, Leidy; *Bison antiquus*, Leidy; *Bison crassicorns*, Richardson; *Harlanus*, Brown.

*Proc. Acad. Nat. Sci. 1842, 190, 216.

Bison latifrons, according to Leidy, has been found in the Quaternary of California, Pennsylvania, Georgia, South Carolina, Kentucky, Mississippi and Texas.

The fossil remains of B. latifrons are found associated with those, the Megatherium and Mastodon, and other species peculiar to the Upper Tertiary and Quaternary.

There have been three, by some authors, four distinct species of extinct American oxen described. Leidy in his Memoir on Extinct Species of American Ox describes four, viz: *Bison latifrons*, *Bison antiquus*, *Bootherium cavifrons* and *Bootherium bombifrons*.

The species *Bootherium cavifrons* seems to have been established by Dr. Leidy, on a specimen which Mr. Thos. Kite, of Cincinnati, took to Philadelphia in 1852 for the inspection of Dr. Leidy.

The specimen was found near Ft. Gibson, on the Arkansas River, in an Indian hut, where it had been used as a seat; the original locality is not known. To this species also Dr. Leidy refers *Bos pallasii* of DeKay. DeKay described the specimen referred to in a paper read before the Lyceum of Natural History of New York, July 9th, 1827.*

The specimen described was a fragment of a cranium from New Madrid, on the Mississippi, which was ejected by the earthquake of 1812. DeKay gave the specimen the provisional name of *Bos palasii*, referring it to a species described by Pallas, found in Siberia.

Dr. Wistar described a fossil cranium with both horn cores attached, found at Big Bone Lick, Ky.; to this Harlan gave the name *Bos bombifrons*, which Leidy refers to genus Bootherium as *B. bombifrons*

It will be of interest to refer for a moment to some fossil remains of oxen described by Lydekker in the Geological Survey of India. Five species are described by him, and the measurements of the horn cores of three of the largest is given below.

Bos namadicus:

Length of horn cores, upper surface, ...	39	inches.
" " " lower "	32	"
Circumference of base.	12.5	"
Interval between the tips	30.0	"

Hackett's specimen from Narbudda Valley, circumference of base, 16 inches.

*An. Lyc. Nat. Hist. New York, 1828. 286

BOS PLANIFRONS.

Circumference of base........................14.5 inches.
Length of fragment,..........................19.0 "

BOS ACUTIFRONS:

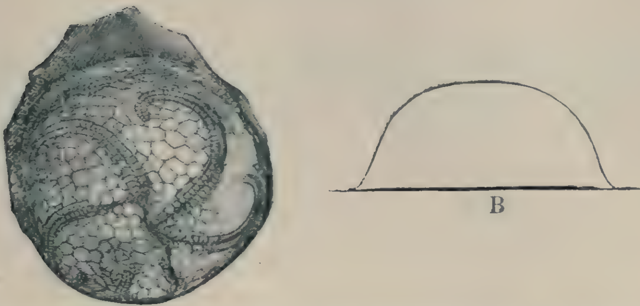
Circumference at base..........................17 inches.
Length, upper curvature.......................49 "
" lower " ....39 "
Interval between broken tips................ 87 "

The last, says Lydekker, is probably the largest of all fossil species.*

*Geol. Sur. of India, Pal. Ind. Ser. x. vol. 1, pt. 3.

GENUS AGELACINUS, Vanuxem.

Agelacrinus holbrooki James.



A B

Fig. A. Agelacrinus holbrooki. James, type specimen natural size, as seen from above. Fig. B. outline, side view of same specimen, showing the dome shaped elevation.

A. holbrooki. James. *The Paleontologist, July*, 1878.

Body circular, subglobose. Disc composed of many thin plates, those in the interradial areas pentagonal or hexagonal, outside squamiform, imbricating; margin of the disc composed of numerous small cuniform and various other shaped plates. Arms or rays not raised above the surface of the disc: four sinistral and one dextral rays, each composed of two rows of interlocking pieces; ends of rays curving quite sharply upward and inward, making nearly a semi-circle, to near the center of the interradial areas, and terminating in a blunt club-shaped form. Ovarian aperture situated subcentrally in the area between the dextral and one of the sinistral rays, depressed and composed of ten cuniform pieces and an outer row of small thin plates, placed apparently on their edges. The end of the dextral ray passes into or against the plates of the ovarian aperture.

Diameter of type specimen, shown in the above figures, A. and B. natural size, at the base 1¼ inches, and measuring from side to side *over* the crown 1¾ inches; convexity ⅝ of an inch.

This species differs from *A. cincinnatienses*, Roemer, as defined and figured by Meek and by Hall, in the shapes of the interradial

plates, the curves and shapes of the rays towards and at the termination, and the convexity of the body: and from *A. pileus*, Hall, the same variations may be stated, except the convexity in which it resembles *A. pileus*.

Position and locality. Cincinnati Group, near Lebanon, Warren county, Ohio.

The accurate drawing and finely executed figure is by Mr. Joseph J. G. Steddom of Lebanon, O.

NOTE—This fine fossil was described a number of years ago by Mr. U. P. James, and published without a figure The beautiful engraving by Mr. Steddom has been offered to the publishing Committee and is now presented to the public with the original description, as a contribution to the paleontology of the Cincinnati Group. —Editor.

THE RELATIVE SIZE OF RED-BLOOD CORPUSCLE AND BRAIN.

By B. Merrill Ricketts, M. D.

(Read January 4, 1887.)

After spending considerable time in looking over the literature and comparing the weights of the brain, size of red corpuscles and nerve tubes, as found in each of the four divisions of the sub-kingdom Vertebrata, I am led to believe that there exists some special relation between them.

We have to consider the relation:

First: Of the red corpuscle to vital force.

Second: Of the brain to activity.

Third: Of the nerve tube to temperature.

While there is a considerable amount of general literature upon the habits and make-up of the animal kingdom, there is nothing to my knowledge that bears directly upon the subject that I present to you, consequently many points that would be of special interest must be omitted.

There are some interesting features in connection with the red corpuscle, not only because it is the messenger that conveys the important elements to the various tissues of the body, but because of its supposed relation to force and activity as well. These are dependent upon digestion, circulation, respiration and muscular structure, and are influenced and controlled by the brain and its appendages.

There is evidence also that force and activity are influenced by the relative size of the red corpuscles to the brain in general, which relation is in an inverse ratio, the corpuscle being small as the brain is large, both the cerebum and cerbellum tend to increase in size, and become more complex in passing from fish to reptiles, from reptiles to birds, and from birds to mammals; also the relative size of the brain to the body is found to vary, as does the ratio of the size of the corpuscle to that of the cerebellum.

That this ratio exists can best be shown by carefully considering each divison of the sub-kingdom vertebrata; this may be done more conveniently by selecting for our types, so far as previous investigation will allow, the largest and smallest animal of each divis-

ion ; but one of the greatest difficulties to overcome is the want of a more extended investigation.

The first class to be considered is the lowest of Vertebrates, viz : cold-blooded animals, commonly known as fish. Their temperature averages 1.70° C. (35.06° F.), while the ratio of the weight of the brain to the body is one to five thousand six hundred and sixty eight, (1 : 5668). We find in the shark a smaller brain compared to the size of the body, than in any other fish ; while in the carp we find the largest brain, in proportion to the size of the body, the proportion being 1 : 560, and the corpuscle measure $\frac{1}{2142}$ inches in diameter, the shark having a brain that weighs $\frac{1}{2498}$ of weight of body, and a corpuscle that measures $\frac{1}{1142}$ inch in diameter.

As you see there is a marked difference in the degree of activity and the power of generating force in these two fish.

The primitive nerve tube or fibre in its natural state is perfectly cylindrical, measuring in the eel $\frac{1}{1043}$ of an inch in diameter ; this being the largest found among fish.

The following measurements, although rather limited in number, will show the inverse ratio of the size of the brain to the body, and of the size of the red blood corpuscle to the brain, the measurements being taken in the fractions of an English inch.

Size of brain to body

Shark	1 : 5668
Pike	1 : 1305
Carp	1 : 560

Size of corpuscle.

Shark	1 : 1142
Eel	1 : 1745
Sturgeon	1 : 1900
Perch	1 : 2090
Carp	1 : 2142

In passing from the lower to the higher Vertebrates, we have next to consider the class of reptiles.

They are of three divisions, viz :

Chelonians, (Tortoise).
Saurians, (Lizards).
Ophedians, (Serpents).

In embryology they are closely allied to birds ; their temperature is but a little higher than that of fish, it being 4.5° C. (40.1° F).

The pulmonary circulation of this class is very incomplete, a

mixed arterial blood being sent to the left lung, while the right lung is usually aborted; the lung is of loose texture and small capacity, the incomplete circulation is due to the pecular communication of the heart with the great vessels, hence a low temperature and sluggish motion.

The product of waste and repair in reptiles during their period of torpidity, can bear no relation to that of warm blooded animals; this limited waste is evidently due to a very much retarded flow of imperfectly oxygenated blood.

I have considered the temperature in this class for the purpose of showing that the animal having the highest degree of temperature also has the smallest red córpuscle, the largest brain, and the greatest degree of activity. The brain to body, in size, is 1:321, and presents on its upper surface a great resemblance to that of fish, while their hemispheres are smooth, non convoluted, hollow internally, and surpass in circumference, the second portion of the brain; compared with the higher order of animal life, their brain is less developed than the spinal cord, while their cerebellum is more highly developed than that of fish. The nerve tube or fibre of this class measures $\frac{1}{1260}$ of an inch in diameter or about $\frac{1}{6000}$ of an inch less than that of the fish. The lizard has the smallest red corpuscle, measuring $\frac{1}{1555}$ of an inch in diam. and a brain proportionately large, something near $\frac{1}{42}$ the weight of the body.

It is the most active of this class, while the siren and the proteus are the most sluggish, each having a corpuscle measuring $\frac{1}{420}$ of an inch in diam; The measurments of a few of this class is found in the following table.

Size of Corpuscle.

Lizard	$\frac{1}{1555}$
Alligator	$\frac{1}{1321}$
Tortoise	$\frac{1}{1252}$
Common Frog	$\frac{1}{1108}$
" Toad	$\frac{1}{1040}$
Triton	$\frac{1}{830}$
Siren	$\frac{1}{420}$
Proteus	$\frac{1}{420}$

We have now to consider our third subdivision, that of birds. Birds are the most active of living creatures; they have a nervous system that is relatively smaller than that of mammals and the ratio of the size of the red corpuscle to the brain—which is 1 : 212—is about the same. Their pulse is more rapid, averaging 150 per

minute, like reptiles their temperature is greater during incubation, but is higher by $13\frac{1}{2}°$ F. than that of any other animal.

Their temperature ranges from 45° F. to 112° F.; this high degree indicates a very great rate of molecular change; their lungs are not so large, nor are they so minutely divided as those of mammals. The respiratory system extends into the abdominal and thoracic cavities, into the spaces between the muscles, beneath the skin, and generally also into the larger bones, all affording a great surface for the action of the air upon the blood, by this means increasing the rate of oxygenation.

It has been shown that birds will die immediately in an atmosphere in which a mouse will survive for a short time, and if we go still lower in the scale we find that a frog will live for hours in the same air. The cerebrum of the bird, which is not convoluted, and the cerebellum are greater in size to that of any other vertebrate, as compared to the size of the body.

This together with the folding of the cerebellum, gives them greater locomotive power; while the relative number of red corpuscles is not so great in birds as in mammals, it exceeds that of reptiles and fish.

The following table shows a great increase in the size of the brain to that of the body in passing from the larger to the smaller birds.

Size of brain to the body.

Goose	1 : 360
Eagle	1 : 260
Cock	1 : 25
Canary	1 : 14
Humming bird	1 : 11

Size of corpuscle in fractions of an inch.

Ostrich	$\frac{1}{349}$	inches in diam.
Raven	$\frac{1}{961}$	"
Swan	$\frac{1}{860}$	"
Pigeon	$\frac{1}{1760}$	"
Duck	$\frac{1}{1923}$	"
Fowl	$\frac{1}{2083}$	"
Cock	$\frac{1}{2153}$	"
Swallow	$\frac{1}{2176}$	"
Humming Bird	$\frac{1}{12000}$	"

Of the above, the ostrich has the greatest strength and physical endurance; however the leading characteristic of bird life (the

power of flight) is absent. We cannot claim for it the greatest activity or rapidity of motion; it has the largest red corpuscle ($\frac{1}{649}$), and a brain of inverse ratio to the body; its temperature is less than that of the smaller and more active members of its class, as the Wren and Humming Bird, the latter being the smallest and most active of them all. The respiration of the ostrich is 24 per minute, this being slower than that of any other bird; in the humming bird the respiration is 60 per minute, this together with a temperature of 4° F. higher than that of any other bird, it being 112° F. implies a greater rate of molecular change, and a greater rate of molecular change enables a smaller nervous system to generate an amount of motion which would require a larger nervous system if the rate of molecular change were less. The brain in this bird (Humming) is much greater in proportion to the size of the body, it being 1 : 11; it has the smallest known corpuscle among birds, measuring $\frac{1}{12666}$ of an inch in diameter, it is proverbial for activity, having been known to visit one hundred flowers in one minute.

The nerve tube or fibre of birds varies is from $\frac{1}{2000}$ to $\frac{1}{3000}$ of an inch in diameter.

We now come to the fourth subdivision, that of mammals, and the last to be considered.

In mammals we find the most intelligence, physical and mental endurance, the largest and most complex nervous and muscular system; they constitute all living vertebrates that suckle their young, including a few aquatics, such as the whale, walrus, seal, sea-lion, and manatee.

The ratio of the brain to the body in mammals in general is 1 : 186, while the temperature ranges from 37° F. to 98.7° F.; relatively they have the greatest number of red blood corpuscles, the size of which varies from $\frac{1}{2748}$ to $\frac{1}{10000}$ of an inch in diameter; the most active animals are those having the highest degree of temperature, the smallest red corpuscle, and the largest cerebellum in proportion to the weight of the body; the brain of mammals differs from all other vertebrates, in that the commissures of the hemispheres and cerebellum, pass across the medulla, thus forming the corpus collosum and pons varolii; those of the cerebrum are more extensive in depth, and number than in either the bird, reptile or fish.

The ratio of the size of the brain to the weight of the body is not so great in passing from the larger to the smaller of this class as is that of birds, this same law governs the size of their red corpucle.

The elephant, in which we find great physical and mental endurance, is capable of accomplishing a greater amount with greater energy exerted in a given time than any other, but like the ostrich has comparatively little activity; he has the smallest brain compared to the size of the body, weighing ten pounds or $\frac{1}{500}$ of weight of the body, the red corpuscle measures $\frac{1}{2745}$ of an inch in diameter. Both respiration and circulation are very slow, the former being 8 and the latter 36 per minute; this is an another illustration that a large corpuscle and a small brain are associated with a slow pulse and respiration and a low degree of temperature and activity.

The most active mammals have a greater amount of gray, as compared to white matter in the brain, and is in proportion to the number and depth of the convolutions, which although not wanting in many vertebrates, are always found in the cerebellum of mammals, the greater portion of which is composed of gray matter.

It has been found that the gray matter is more vascular than the white, therefore the amount of blood that would pass through a given quantity of each in a given time, would be much greater in the the gray than in the white; this facilitates a greater rate of molecular change, and the change is influenced by the rate of respiration and circulation.

Of mammals, the Java Musk deer has the smallest known red corpuscle; it measures $\frac{1}{10000}$ of an inch in diameter; there seems to be no available record concerning the weight of its brain, however the animal is known to be of the most active of its class. Investigations concerning this class of vertebrates seems to have been more thorough and more general than of any other class, as may be shown by the following table, which includes quite a variety.

Ratio of the brain to the body.

Ox	1 : 860	Sheep	1 : 192
Wild Boar	1 : 670	Hedge Hog	1 : 168
Domestic Boar	1 : 412	Ass	1 : 154
Horse	1 : 400	Rabbit	1 : 152
Stag	1 : 290	Bat	1 : 96
Wolf	1 : 230	Baboon	1 : 86
Hare	1 : 228	Rat	1 : 76
Calf	1 : 219	Demur	1 : 61
Fox	1 : 205	Gibbon	1 : 48
Buck	1 : 194	Mouse	1 : 43
Ape	1 : 24		

The following table shows the greatest decrease in size of corpuscles in passing from the larger to the smaller animals.

If more extensive examinations of mammals, birds, reptiles, and fish were made concerning the size of their corpuscles and brain, the results would be more satisfactory.

Size of Red Corpuscle in fractions of an English inch.

Elephant	$\frac{1}{2745}$	Whale	$\frac{1}{3099}$
Mare	$\frac{1}{3225}$	Beaver	$\frac{1}{3325}$
Guinea Pig	$\frac{3}{3432}$	Hare	$\frac{1}{3560}$
Wolf	$\frac{1}{3600}$	Rabbit	$\frac{1}{3607}$
Mouse	$\frac{1}{3614}$	Monkey	$\frac{1}{3624}$ - $\frac{1}{3338}$
Bear	$\frac{1}{3693}$	Ass	$\frac{1}{4000}$
Tiger	$\frac{1}{4206}$	Pig	$\frac{1}{4230}$
Ox	$\frac{1}{4267}$	Lion	$\frac{1}{4322}$
Red Deer	$\frac{1}{4324}$	Cat	$\frac{1}{4404}$
Bat	$\frac{1}{4465}$ - $\frac{1}{4175}$	Horse	$\frac{1}{4600}$
Sheep	$\frac{1}{5300}$	Goat	$\frac{1}{6366}$
		Musk Deer	$\frac{1}{10000}$

In conclusion I would say that while the foregoing tables and statements concerning the inverse ratio of the red corpuscles to the brain, the brain to the body, the red corpuscle to the cerebellum, also to force and activity, are not complete, yet they furnish evidence sufficient to encourage further investigation, which will sooner or later be pursued. I have endeavored to give the size of the Corpuscle and weight of the brain, and, also as nearly as possible, the capacity and structure of the lung, the degree of temperature, rate of respiration and circulation, the habits and development of as many members as possible of each of the four classes of vertebrates, that a more complete study might be made.

We have found in passing from fish to mammals, that not only does intelligence develop, but that circulation, respiration, digestion and muscular structure are all likewise increased, and that the brain becomes larger as does the cerebellum, while the red corpuscle grows smaller, as does the nerve tube or fibre, which varies $\frac{1}{185}$ to $\frac{1}{6300}$ of an inch in diameter.

CATALOGUE OF THE MAMMALS, BIRDS, REPTILES, BATRACHIANS AND FISHES.

IN THE COLLECTION OF

THE CINCINNATI SOCIETY OF NATURAL HISTORY.

Compiled by Prof. JOSEPH F. JAMES.

(Concluded from Vol. 9, Page 64.)

CLASS III.—REPTILIA.
(The Reptiles.)

Order 1. Testudinata.
(The Turtles.)

Family Emydidæ.
(The Pond Turtles.)

Chrysemys picta, Agass. Painted Turtle. 2290, (M't'd)
Cistudoclausa, Gm. Common Box Turtle. 2291, (Shell)

Family Cinosternidæ
(The Cinosternoid Turtles.)

Cinosternum pennsylvanicum, Bell. Small Mud Turtle. 2292, (Shell)

Family Chelydridæ.
(The Snapping Turtles.)

Chelydra serpentina, Schw. Common Snapping Turtle. 2293, (M't'd.)

Family Trionychidæ.
(The Soft Shelled Turtles.)

Aspidonectes spinifer, Agass. Common Soft-shell Turtle, 2289, (M't'd.)

Order 2. Lacertilia.
(The Lizards.)

Family Iguanidæ.
(The Iguanas.)

Iguana tuberculata (?). S. Am. Iguana. 2294. (M't'd).
Phyrnosoma cornutum, Gray. Horned Toad. 2269.

Order 3. Ophidia.
(The Serpents.)

Family Colubridæ.
(The Colubrine Snakes.)

Bacanium constrictor, B. & G. Black Snake. 2256.

Coluber obsoletus, Say. Pilot Snake: Racer. 2254.

Eutænia saurita, B. & G. Riband Snake: Swift Garter Snake. 2265.

Eutænia sertalio, B. & G. Common Garter Snake. 2252.

Leopeltis vernalis, Jan Green Snake; Grass Snake. 2249.

Ophibolus doliatus, var. triangulidus, Cope. Milk Snake: House Snake. 2255.

Tropidonotus sipedon, Holbr. Water Snake; Water Adder. 2250.

Family Pythonidæ.
(The Pythons.)

Eunectes marinus. Anaconda. M't'd. (3 Specimens.)

Family Elapidæ.
(The Harlequin Snakes.)

Elaps fulvius, Cuv. Bead Snake. 2253.

Family Crotalidæ:
(The Rattlesnakes.)

Caudisona terginuna, Cope. Massassanga; Prairie Rattl e snake. 2251.

Crotalus horridus, L. Banded or Northern Rattlesnake. M't'd. (Two Specimens.)

Order 4. Crocodilia.
(The Crocodiles.)

Alligator mississippiensis, Dand. Alligator. Large M't'd. Small M't'd, 2262; Small Male, 2261; Scales, 2263.

Class IV.—Batrachia.
(The Batrachians.)

Order 1. Anura.
(The Frogs and Toads.)

Family Ranidæ.
(The Frogs.)

Rana halecina, Kalm. Leopard or Common Frog.

Family Hylidæ.
(The Tree Frogs.)

Hyla versicolor, LeConte. Common Tree Toad. 2264.

Family Bufonidæ.
(The Toads.)

Bufo lentiginosus, Shaw. American Toad. 2260.

Order 2. Urodela.
(The Salamanders.)

Family Plethodontidæ.
(The American Salamanders.)

Gyrinophilus porphyriticus, Cope. Purple Salamander. 2258.

Plethodon erythronotus, Baird. Red-Backed Salamander. 2259.

Family Amblystomidæ.
(The Amblystomas.)

Amblystoma punctatum, Baird. Large Spotted Salamander 2268.

Family Menopomidæ.
(The Memopomes.)

Memopoma alleghaniense, Harlan. Hell-bender: Big Water Lizard. Male, 2249. (also M't'd.)

Order 3. Proterida.
(The Proteans.)

Family Proteidæ.
(The Mud Puppies.)

Necturus lateralis, Baird. Mud Puppy: Water Dog. 2266.

Class V.—Pisces.
(The Fishes.)

Elasmobranchii.

Order 1. Squali.
(The Sharks.)

Family Spinacidæ.
(The Dog-fishes)

Squalus acanthias, Linn. Dog-fish: Skittle-dog. 2158.

Family Scylliidæ.
(The Roussettes.)

Scyllium ventricosum, Garman. Swell Shark. 2159.

Order 2. Raiæ.

(The Rays.)

Family Pristidæ.

(The Saw-fishes.)

Pristis antiquorum, Latham. Saw Fish. 2160.

The saw sometimes grows to be six feet long an one foot across at the base. It is used in tearing pieces of flesh from an animal's body. The detached fragments are then seized and swallowed.

Family Trygonidæ.

(The Sting Rays.)

Urolophus halleri, Cooper. Round Sting-ray. 2162.

Some parts of the bottom of San Diego Bay are literally lined with this species, nearly buried in sand and mud. The smallest, most abundant and most dangerous of the sting rays. One taken in a net struck at another, the sting passing through the body. The species grow to be eighteen inches long.

Dasibatis sayi, Goode and Bean. Sting ray. 2164.

Order 3. Holocephali.

(The Chimæras.)

Family Chimaeridae.

Chimæra colliæi, Bennett. Rat-fish: Elephant Fish. 2163.

Pisces.

(True Fishes.)

Order 1. Selachostomi.

(Paddle Fishes.)

Family Polyodontidae.

(Paddle Fishes.)

Polyodon spathula, Jord, and Gilb. Spoon-bill Cat. 2161.

Order 2. Glaniostomi.

(The Sturgeons)

Family Acipenseridae.

(The Sturgeons.)

Acipenser rubicundus, Le Sueur. Lake Sturgeon, Ohio Sturgeon. 2167.

The largest of our lake fishes. sometimes attaining a length of six feet and over. In 1872 – 73 at Green Bay Wis., 14,000 mature sturgeons, weighing 700,000 pounds were handled.

Acipenser sturio, var oxyrrhynchus. American Sturgeon 2166.

Scaphirrhynchops platyrrhynchus, Gill. Shovel nosed Sturgeon. 2165.

Only four species of this genus are known: the present American and three others, all from Central Asia.

Order 3. Ginglymodi.
(Gar Pikes)

Family Lepidosteidæ.
(The Gar Pikes.)

Lepidosteus osseus, Agassiz. Long-nosed Gar; Gar Pike. 2157.

This has been divided into twenty-two distinct species on the proportions and number of the scales. It is a quiet fish, it is said that it may be seen apparently sleeping on the surface, and gently carried round on an eddy for an hour at a time.

Order 4. Nematognathi.
(The Cat Fishes.)

Family Siluridæ.
(The Cat Fishes.)

Amiurus catus, Gill. Bull-head; Horned Pout; Cat Fish. 2169.

Extremely tenacious of life, opening and shutting mouth half an hour after the head has been cut off.

Amiurus (Ictalurus) albidus, Gill. White Cat Fish. 2170

Noturus insignis, Gill and Jord. 2168.

Order 5. Plectospondyli.
(The Plectospondylous Fishes.)

Family Catostomidæ.
(The Suckers.)

Catostomus teres, LeSueur. Sucker. 2172.

The common "Sucker" of the streams of Ohio. Flesh poor. It varies much in size, color and form in various streams.

Erimyzon sucetta, Jordan. Chub Sucker; Creek Fish. 2171.

Family Cyprinidæ.
(The Carps.)

Mylochilus caurinus, Grd. Columbia Chub. 2174.

Semotilus bullaris, Jord. Fall Fish; Silver Chub. 2173.

Order 6. Isospondyli.
(The Isospondylous Fishes.)

Family Clupeidæ.

(The Herrings.)

Brevoortia tyrannus, Goode. Menhaden; Mossbunker; Bug-fish; Fat Back. 2175.

Very variable in all its characters. The annual yield of oil from this fish exceeds that of the whale. "A parasitic crustacean (*Oniscus prægustator*, Lat.) is found in the mouths of a very large proportion of the individuals of this species. The specific names of both the fish and the crustacean refer to this pecularity, the ancient Roman Rulers (*tyranni*) having had their tasters (*prægustatores*) to taste their food before them, to prevent poisoning.

Clupea harengus, Linn. *The* Herring. 2177.

Found in incredible numbers in the German Ocean, North Atlantic and seas north of Asia. The so-called "White Bart" consists chiefly of the fry or young of herrings.

Clupea sagax, Jewyns. California Sardine. 2176.

Spread all over the temperate and tropical zones; found in large shoals on the coast of California, Chili, New Zealand and Japan.

Clupea sapidissima, Wilson. Common Shad. 2178.

Highly esteemed in the East as a food fish, but inferior in taste to all who have been accustomed to eat white fish in the West.

Family Dorosomatidæ.

Dorosoma cepedianum, Gill. Gizzard Shad; Hickory Shad. 2179.

A handsome fish, but almost worthless as food. Flesh soft, insipid and full of bones. (Mr. Klippart states that "40 years ago it was esteemed an excellent fish on the Cincinnati market," which if true, shows that either the Cincinnatians do not now buy fish for their good looks, or else in 40 years they have progressed a long way toward epicurianism.)—(Jordan.)

Family Engraulididæ.

(The Anchovies.)

Stolephorus compressus, J. and G. Sprat. 2182.
Stolephorus delicatissimus, J. and G. Sprat. 2180.
Stolephorus ringens, J. and G. Anchovy. 2181.

Family Scopelidæ.

(The Scopelids.)

Synodus lucisceps, Gill. Dingaree dock. 2183.

Family Salmonidæ.

(The Salmon.)

Osmerus mordax, Gill. Common Smelt. 2187.

Osmerus thaleichthys, Ayres. 2188.

Salmo irideus, Gibbons. California Brook Trout; Rainbow Trout. 2185.

The genus *Salmo* is a variable one. No dependence can be placed on any of the characters. The young are known as "parr" and differ in many ways from the adult. The adult males are more intensly colored than the females. The water has a marked influence on the colors. "Trout with intense ocellated spots are generally found in clear rapid rivers, and in alpine pools; in the large lakes with pebbly bottom the fish are bright silvery and the ocellated spots are mixed with or replaced by X shaped black spots; in dark holes, or lakes with peaty bottom, they often assume an almost uniform blackish coloration." (Gunther). The species interbreed and cross and in the size, the fins and scales they vary greatly.

Salmo purpuratus, Pallas. Oregon Brook trout; Salmon trout. 2184.

A very variable species. The probable ancestor of a number of reputed species.

Salvelinus fontinalis, G. and J. Speckled or Brook trout. 2226.

Thaleichthys pacificus, G. and D. Candle Fish: Eulachon. 2186.

A very fat fish. An oil has been prepared from them similar to cod liver oil. The common name of "Candle Fish" is given from the fact that if set on fire at one end they burn like a torch till consumed. The oil is highly prized by the Indians of the north west coast. Large quantities of the fish are caught in nets; they lie in heaps on the ground for five or six days, and are then boiled. The atmosphere is charged at that time with odors far from agreeable.

Thymallus tricolor, Cope. Grayling. 2227.

Family Percopsidæ.

Percopsis guttatus, Agass. Trout perch. 2189.

The only genus and species of the family.

Order 7. Haplomi.

Family Cyprinodontidæ.

Cyprinodon variegatus. Lac. Sheep's head. 2192.

Fundulus parvipinnis, Gir. 2191.

Fundulus pisculentus, Val. Common Kitli fish: Munimichog. 2190.

Family Eocidæ.

(The Pikes.)

Esox reticulatus, Le Sueur. Jack: Pickerel: Green Pike. 2195.

Order 8. Apodes.

(The Eels.)

Family Anguillidæ.

(True Eels)

Anguilla rostrata, De Kay. Eel. 2193.

Anguilla vulgaris, Turton. Eel. 2194.

Order 9. Synentognathi.

Family Scomberesocidæ.

(Gar-fishes and Flying fishes.)

Exocœtus californicus, Cooper. Flying Fish. 2199.

This species sometimes flies for a distance of a quarter of a mile, usually rising three or four feet. Some species jump twenty feet above the water. Its motion is very swift, and it is able to turn in its course to shun an obstacle.

Tylosurus longirostris, J. and G. Gar Pike: Needle Fish. 2196.

The bones in this genus are green, yet the flesh is said to be good eating. The lower jaw, when growing is longer than the upper.

Order 10. Lophobranchi.

Family Sygnathidæ.

(Pipe-fishes.)

Siphostoma fuscum, J. and G. Common Pipe Fish. 2197.

Family Hippocampodæ.

(Sea Horses.)

Hippocampus heptagonus, Raf. Sea Horse. 2198.

Order 11. Heæibranchi.

Family Gasterosterdæ.

(The Sticklebacks.)

Opeltes quadracus, Brevort. 2202

Gasterosteus aculeatus, L. Common Stickleback. 2200.

Common to Atlantic and Pacific coasts of N. Am. Noted for

its habit of building a nest in the breeding season. Many species of the genus build very elaborate nests.

Gasterosteus aculeatus, var. cataphractus, J. and G. Salmon-killer. 2201.

Order 12. Acanthopteri.
(Spiny-rayed Fishes.)

Family Atherinidæ.
(The Silver Sides.)

Atherinops affinis, Steind. Little Smelt. 2203.

Chirostoma merridium, Gill. Sardine. 2204.

Leuresthes teruuis, J. and G. 2205.

Family Ammodytidæ.
(Sand Launces.)

Ammodytes americanus, DeKay. Sand Eel. 2207.

Fish of this genus live in shoals, rising with one accord to the surface, or else diving to the bottom, where they bury themselves in the sand. Porpoises watch the shoals and keep them at the surface by diving below and swimming round them. Large numbers are thus destroyed.

Family Scombridæ.
(The Mackerels.)

Scomber scombrus, Linn. Eastern Mackerel. 2206.

A very important food fish, with a body temperature several degrees higher than other fishes.

Family Carangidæ.
(The Pilot Fishes.)

Caranx crumenopthalmas, L. Goggler; Big-eyed Scad. 2213.

Caranx hippus, Gthr. Horse Crevalle. 2211. Found in both Atlantic and Indian-Pacific oceans.

Caranx pisquetus, Cuv. and Val. Leather Jacket. 2210.

Selene vomer, Lutken. Moon fish; Look-down; Horse-head. 2156.

Seriola zonata, C. and V. Rudder Fish. 2212.

Trachurus plumeri, J. and G. 2208.

Trachynotus carolinus, Gill. Pompano. 2209.

Said to be the most valuable food fish of our Southern waters.

Family Pomatomidæ.
(The Blue Fishes.)

Pomatomus saltator, Gill. Skip-jack; Blue fish. 2214.

The favorite of fishermen of seaside resorts. A specimen

showed signs of life after fifteen minutes on the deck of a yacht, and a fragment of a little more than half a heart continued to pulsate for eight minutes after being separated from the body, responding to artificial stimulus fifteen minutes longer.

Family Stromateidæ.

(Broad Shiners.)

Lirus perciformis, J. and G. Rudder Fish. 2217.

Stromateus simillianus, Gill. Cal. Pompano. 2216.

"Best pan fish on the Pacific coast. It sells for from 25 to 50 cents per pound."

Stromateus triacanthos, Peck. Dollar fish; Butter fish. 2215.

Family Centrarchidæ.

(Sun Fishes.)

Amblopeltis rupestris, Gill. Rock Bass; Goggle-eye. 2223.

Centrarchus macropterus, Jordan. Shining Bass. 2219.

Lepomis auritus, Raf. Long-eared Sun fish. 2222.

Lepomis gibbossus, McKay. Pumpkin seed; Sun fish. 2221-2225.

This species clears away weeds and other matter from the sand and excavates a nest to the depth of three or four inches. It guards the eggs from all intruders. Thoreau says of it: "Seen in its native element it is a very beautiful and compact fish, perfect in all its parts, and looks like a brilliant coin fresh from the mint. It is a perfect jewel of the river, the green, red, coppery and golden reflections of its mottled sides being the concentration of such rays as struggle through the floating pads and flowers to the sandy bottom, and in harmony with the sun-lit brown and yellow pebbles."

Lepomis megalotis, Cope. Long-eared Sun fish. 2224.

Variable and described under a multitude of names.

Micropterus salmoides, Henshall. Large-mouthed Black Bass. 2220.

This species and the small-mouthed bass have been the subjects of much controversy, some contending that the species are distinct, and others that intermediate forms exist which connect the two. Vol. IV of the Ohio Geog. Survey, pp. 942–953, contains a long account of the genus and species. A paper was published in this Journal, (VII, p. 140), by Mr. Chas. Dury, giving reasons for supposing there are no constant differences between the small and large-mouthed varieties. Dr. J. A. Henshall's "Book of the Black Bass" is the most complete account yet published.

Pomoxys sparoides, Gerard. Calico fish; Bar fish; Tin Mouth. 2218.

Family Percidæ.
(The Perches.)

Perca americana, Schrank. Common Perch; Yellow Perch. 2102.

A handsome fish, "biting" says Thoreau, "from impulse, without reflection, and from impulse refraining to bite; and sculling indifferently past. It is a true fish, such as the angler loves to put into his basket, or hang on the top of his willow twig, on shady afternoons, along the banks of streams" "The number of eggs of one spawn may exceed a million".—(Gunther.)

Family Serranidæ.
(The Sea Bass.)

Roccus americanus, J. and G. White Perch. 2101.

Roccus lineatus, Gill. Rock; Striped Bass. 2098.

Serranus atrarius, J. and G. Black fish; Black Sea-Bass. 2099.

Serranus nebulifera, Steind. Johnny Verde. 2100.

Family Sparidae.
(The Sparoid Fishes.)

Pomadasys fulvomaculatus, J. and G. Sailor's Choice; Pig Fish. 2096.

Diplodus argyrops, J. and G. Scup; Porgee. 2097.

An important food fish, growing eighteen inches in length and reaching a weight of four pounds.

Family Sciænidæ.
(The Croakers.)

"Most of the species make a peculiar noise, called variously croaking, grunting, drumming and snoring. This sound is supposed to be caused by forcing the air from the air bladder into one of the lateral horns".—(Jord. and Gilbert, Fishes, N. Am., p. 566.)

Cynoscion parvipinne, Ayres. Blue Fish; Corvina. 2092.

Genyonemus lineatus, Gill. Little Bass; Little Roncador. 2093.

Menticirrus nebulosus, Gill. Whiting; King Fish. 2094.

Umbrina xanti, Gill. Yellow-finned Roncador. 2095.

Family Embiocotidæ.
(The Surf Fishes.)

"Viviparous. The young are hatched within the body, where

they remain closely packed in a sac-like enlargement of the oviduct until born. These fœtal fishes bear at first little resemblance to the parent, being closely compressed and having the vertical fins exceedingly elevated, at birth they are from 1½ to 2½ inches in length."— (Jord. & Gilb. Ibid, p. 585.)

Abeona aurora, J. and G. 2090.

Abeona minima, Gill. Shiner. 2091.

Amphistichus argenteus, Agass. Surf Fish. 2078.

Damalichthys argyrosomus, J. and G. White Perch Porgie. 2084

Ditrema atripes, J. and G. 2082.

Ditrema furcatum, Gunther. 2079.

Ditrema jacksoni, Gthr. Croaker; Surf Fish. 2081.

Ditrema laterale, Gthr. Blue Perch. 2080.

Amphistichus (Holconotus) analis, J. and G. 2089.

Amphistichus (Holconotus) argenteus, Agass. White Perch; 2984. Wall Eye. 2087.

Amphistichus (Holconotus) rhodoterus, J. and G. 2088.

Hypsurus caryi, A. Agass. Bugara. 2086.

Micrometrus aggregatus, Gibbons. Sparada; "Minnow". 2085.

Micrometrus frenatus, J. and G. 2083.

Family Labridæ.

(The Wrasse-Fishes.)

Ctenolabrus adspersus, Goode. Cunner; Chogset. 2077.

Pseudojulis modestus, Gthr. Senorita. 2075.

Tautoga onitis, Gthr. Oyster Fish; Black Fish. 2076.

Esteemed as food.

Family Pomacentridæ.

Chromis punctipinnus, Cooper. Blacksmith. 2074.

Family Gobiidæ.

(The Gobies.)

Gillichthys mirabilis, Cooper. Mud Fish. 2070.

Burrows in the mud; the bottom of San Diego Bay being honey-combed with its holes.

Family Chiridæ.

Anoplopoma fimbria, Gill. Horse Mackerel; Coal Fish. 2073.

Hexagrammus decagrammus, J. and G. Sea Trout; Boregat. 2071.

Zaniolepis latipinnis, Grd. 2072.

Family Scorpænidæ.
(Rock Fishes.)

Sebastes marinus, Linn. Rose Fish; Snapper. 2134.
Sebastodes atrovirens, J. and G. Garrupa; Grouper. 2130.
Sebastodes auriculatus, J. and G. Rock Fish. 2131.
Sebastodes chrysomeles, J. and G. 2133.
Sebastodes rosaceus, J. and G. Corsair.

Family Cottidæ.
(The Sculpins.)

Ascelichthys rhodorus, J. and G. 2120.
Cottus æneus, Mitchell. Brazen Bull Head. 2121.
Cottus octodecimspinosus, Mitch. Sculpin. 2127.

The male of some species of this genus is said to construct a nest of sea-weed and stones, and to watch and defend his offspring (Gunther.)

Enophrys bison, J. and G. Stone Sculpin. 2128.
Hemipterus americana, Storer. Sea Raven. 2129.
Icelus quadriseriatus, J. and G. 2123.
Icelus uncinatus, Kroger. 2125.
Leptocoltus armatus, Girard. Sculpin; Drummer. 2126.
Oligocottus analis, Grd. Little Scorpion, 2122.
Oligocottus maculosus, Grd. Johnny. 2124.

Family Agonidæ.
(Alligator Fi-hes.)

Aspidophoroides monopterygius, Storer. Bull-head. 2116.

Family Triglidæ.
(The Gurnards.)

Cephalacanthus spinarella, Lac. Flying Fish. 2119.

"The adult able to move in the air, like the true flying fish, but for shorter distance."—(J. & G., *l. c.*, p. 737.)

Prionotus evolans, Gill. Striped Flying Toad. 2117.
Prionotus palmipes, Storer. 2118.

Family Gobieosocidæ.

"Carnivorous fishes of small size, chiefly of the warm seas, usually living among loose stones between tide marks, and clinging to them firmly by means of the adhesive disk."—(Jor. and Gil., *l. c.*, p. 748.)

Gobieosox reticulatus, J. and G. 2114.

Family Batrachidæ.

(Toad Fishes.)

Porichthys porosissimus, Gthr. Mud Fish; Singing Fish; Drum Fish. 2115.

Family Blenniidæ.

Anoplarchus alectrolophus. J. and G. 2113.

Inhabits regions between tide marks, where it is sheltered from the surf. Usually found among weeds and stones where the bottom is very muddy.

Apodichthys fucourm, J. and G. 2110.

Cebedichthys violaceus, Grd. 2111.

Lumpenus anguillaris, Gill. 2112.

Muraenoides ornatus, Gill. 2107.

Xiphister mucosus, Jordan. 2108.

Lives under rocks, in the sand, in crevices and in masses of algæ between tide marks. It is very active and makes its way readily on land, and remains for hours out of the water in damp places without inconvenience.

Xiphister rupestrus, J. and G. 2109.

Family Lycodidæ.

(The Eelpouts.)

Zoarces auguillaris, Storer. Mutton Fish; Eelpout, 2106.

The young fish of *Z. viviparus* are so mature at the time of birth, that when they are first extruded they swim about with great agility. Two or three hundred are sometimes produced by a single female.

Family Gadidæ.

(Cod Fishes.)

Gadus vireus, L. Coal Fish; Green Cod. 2105.

Gadus tomcod, Walb. Tom-cod; Frost Fish. 2103.

Phycis tennis, DeKay. Codling; Squirrel-hake. 2104.

Order 12.—Heterosomata.

(The Flat Fishes.)

Family Pleuronectidæ.

(Flounders.)

Bothus maculatus J. and G. Sand Flounder; Window-pan. 2145.

Citharichthys sordidus, Gthr. 2146.

Dried in numbers by the Chinese. Its weight is about one and a half pounds.

Glyptocephalus cynoglossus, Gill. Craig Flounder. 2150

Glyptocephalus zachirus, Lock. Sole. 2149,

Hippoglossoides exilia, J. and G. Flounder. 2148.

Hippoglossoides plattessoides, Gill. Flat Fish; Rough Dab. 2142.

Hypsopetta guttulata, Gill. Diamond Flounder. 2147.

Paralichthys californicus, J. and G. Turbot. 2140.

Grows, three feet long and is sometimes known to weigh sixty pounds.

Pleuranectes americanus, Walb. Winter Flounder. Mud-dab. 2139.

Pleuronectes bilineatus, Gthr. Rock Sole. 2143.

Pleuronectes ferrugineus, J. and G. Sand-dab. 2144.

Pleuronectes glaber, Gill. Fool Fish, Christmas Fish. 2135.

Named "Fool-fish" because it will bite even at a rag. The teeth of the old ones are movable in the breeding season; those of the young are fixed.

Pleuronectes isolepis, J. and G. 2137.

Pleuronectes stellatus, Pallas. Flounder. 2136.

Pleuronectes vetulus, J. and G. 2138.

Pleuronichthys decurrens, J. and G. 2141.

Order. 13 Plectognathi.

Family Ostraciidæ.
(Trunk Fishes.)

Ostracium quadricorne, L. Cow-fish (dried). 2152.

Family Balistidæ.
(Trigger Fishes.)

Alutera schœpffi, Goode. File Fishes. 2155.

Monacanthus broceus, DeKay. Fool-Fish; File-Fish. 2154.

Family Tetrodontidæ.
(The Puffers.)

Chilomycterus geometricus, Kaup. Rabbit-Fish; Swell Toad. (M't'd). 2153.

Tetrodon turgidus, Mitchell. Swell Fish: Puffer. 2151.

This species takes its name from its power of inflating itself with air.

ZOOLOGICAL MISCELLANY.

WM. HUBBELL FISHER, Editor.

SNOW BUNTING, *Plectrophanes nivalis*, (L.) MEYER.

Rev. John W. Shorten, a well-known ornithologist, formerly of this city, and now of Ross, Butler County, Ohio, writes under date of January 3, 1887, as follows:

"Yesterday while driving from one of my preaching appointments to another in this (Butler) county, I had the pleasure to see a large flock of Snow Buntings, *Plectrophanes nivalis*, Meyer. They flew directly across my path and so close that I had a good view of them, and could not mistake the species—I have handled many of them. This bird is reported by our local collectors as an 'occasional winter visitant.' But, in all my collecting, I have not met with it heretofore. All of the specimens that I have handled were sent to me from farther west. I thought my ornithological friends would appreciate this item, and so you have it."

Very respectfully, JOHN W. SHORTEN.

AMERICAN ROUGH-LEGGED HAWK, *Archibuteo Lagopus Sancti-Johannis*, (Gmel.) Ridgw.

James B. Shorten, of Cincinnati, Ohio, has mounted a Rough-legged Hawk, which he reports taken on or about January 7-9, 1887, at Indian Hill, (Plainville), Hamilton County, on the Little Miami River, Ohio.—body dissected by Wm. Hubell Fisher, sex of bird, male; also a Rough-legged Hawk, taken on or about January 2, 1887, at Greensburgh, Indiana, (a large specimen), body dissected by Wm. Hubbell Fisher, sex, female (?) This species is very uncommon in Southern Ohio.

RED-TAILED HAWK, *Buteo borealis*, (Gm.) Vieill.

Contest with the common American Crow, *Corvus frugivorus*, Bartr.

At Lyons Falls, Lewis County, New York, in the spring of

1886, a young crow was taken from the nest and domesticated at the Lyon homestead, and became the pet of the family. He would often fly to the windows of the house and look in. He was exceedingly fond of Joe, the gardener, and would often perch upon the hat of the latter, while walking about the grounds, and allow himself to be taken down, and would sit upon Joe's finger. If one pointed a finger at him, he would open wide his mouth and emit a low half hissing, half cawing sound.

He liked to tease. A small fat puppy, black all over, except the tip of his tail which was white, shared the honors of being a pet.

The crow (we called him "Jim,") used to come stealthily up behind the puppy, and with his beak suddenly nip the white tip of the puppy's tail. Although the puppy jumped to his feet and turned round with astonishing celerity, he failed to catch the offender, who nimbly, by jumps and aided by his wings, kept out of harm's way.

I have seen him when the puppy was picking a bone, make a pass at the latter, and as the puppy dropped the bone to meet his attacker, Jim dextrously caught the bone and bore it aloft to a safe branch in triumph.

Nearly every afternoon, near sun down, many wild crows passed over-head in full view, often cawing vociferously, and on several of these occasions I have closely observed Jim. I have seen him watch these crows, but he never appeared to care to join them in their wild life, preferring the companionship of man.

Last fall, November 8, 1886, I received from Lyons Falls the cadaver of a Red-tailed Hawk—Hen-Hawk—*Buteo borealis*, (Gm.) V., and a letter announcing that on November 4, 1886, this hawk had attacked the crow and a combat ensued, in which the crow had, for the time being at least, gotten the better of his powerful adversary, and held the hawk until Joe, the gardener, came and seizing the hawk despatched it.

This hawk is a bird probably of the year. In the flesh it measured as follows:

Length $21\frac{1}{2}$ inches from tip of beak to tip of tail measured over the back. From tip of beak to root of tail, $12\frac{3}{8}$ inches. Length of wing from shoulder to tip of third primary, $15\frac{1}{8}$ inches. Alar extent from tip of one wing to tip of other wing, the wings

being outstretched and the measurement being taken across the back, 47½ inches.

Sex undetermined.

The skin of the specimen is in my possession.

The stomach of the bird contained a small quantity of hair, a few bones of a small animal, and some seeds. No doubt the hawk was hungry, and being a young bird, was not sufficiently wary to remain away from the vicinity of the house.

A query also arises whether the crow, by his play with men and with the dog, acquired greater skill and confidence than a wild crow, and became better able to cope with a hawk of such size.

WM. HUBBELL FISHER.

PLATE I.—Page 19.

Horn cores of Bison latifrons, Leidy—$\frac{1}{2}$ natural size.

THE JOURNAL

OF THE

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PROCEEDINGS.

ANNUAL MEETING, *April* 5, 1887.

President Dun in the chair, twenty members present.

Minutes of the January Meeting were read and approved.

Miss Susan Griffith and Dr. S. H. Collins were proposed for election to active membership.

Dr. N. E. Jones, of Circleville, Ohio, was recommended by the Executive Board as Honorary member.

The following named persons were then elected :

Corresponding members, Rev. Stephen D. Peet, Clinton, Iowa, and Prof. O. P. Hay, Irvington Indiana; Honorary member, Prof. E. W. Claypole, Akron, Ohio; Active members, Mrs. Thomas Emery, Mrs. Herbert Jenney, Mrs. W. D. Holmes, D. B. Gamble, Jerome R. Clark, R. S. Fulton, J. K. Martin, Charles T. Greve, W. D. Holmes, W. F. Gray, E. Y. Mosier, Dr. A. L. McCormick.

The minutes of the Executive Board for December, January, February and March were read.

Reports of the various officers and curators were called for and the following reports were submitted : *

Davis L. James, Secretary; H. P. Smith, Custodian; S. E. Wright, Treasurer; Prof J. W. Hall, Curator of Geology; George Huntington, Curator of Entomology; Curator of Botany, Miss Nettie Filmore; Curator of Zoology, Charles Dury; Curator of Osteology, Dr. O. D. Norton; Curator of Anthropology, Prof. George W. Harper; Curator of the Photgraphic Section, George

* These reports will appear in subsequent pages of the Journal.

Bullock; Curator of Conchology, Mrs. M. C. Morehead; Curator of Microscopy, George B. Twitchell; Librarian, Prof. George W. Harper.

The resignations of Messrs. G. N. Merryweather and William Lytle Foster were received and accepted.

The Annual Election was then announced, and the chair appointed Messrs. Karl Langenbeck and H. P. Smith, tellers.

The following officers were then elected to serve for one year:

President, J. Ralston Skinner; First Vice-President, William Hubbell Fisher; Second Vice-President, Davis L. James; Treasurer, S. E. Wright; Secretary, William H. Knight.

Members at large for the Executive Board:

W. A. Dun, M. D., George Bullock, Prof. George W. Harper, F. W. Langdon, M. D.

Librarian, Miss Nettie Fillmore. Trustee for two years, Julius Dexter.

The election of Curators was postponed to the next meeting.

Mr. Fisher moved that the thanks of the society be tendered to Dr. Dun for his efficient services during the past year. Carried.

The society then adjourned.

Donations for the month were as follows:

From Dr. W. A. Dun, plate of "Cincinnati Warbler" framed; from F. W. Langdon, beetle; from Prof. J. W. Hall, Naturalist's Directory 1884. Ohio Centennial Report; from Henry A. Shepherd, "Antiquities of the State of Ohio," from Capt. M. M. Murphy, Ripley, O., Mastodon tooth, five stone axes, twenty-four flint arrow-heads, three rough agates, miscellaneous fossils; from J. G. Shepherd, Mason, O., miscellaneous fossils and fungi; from Lars Sundt, mammoth tooth.

Scientific Meeting, *May* 3, 1887.

President Skinner in the chair; twenty-four members present.

The minutes of the March meeting were read and approved.

A communication from E. W. Claypole thanking the society for his election to honorary membership was read. Also, from Messrs. O. P. Hay and Stephen D. Peet, returning thanks for their election to corresponding membership.

Dr. O. D. Norton read an interesting letter from a friend who had been examiming the phosphate works near Beaufort, S. C.

The dredges are bringing to the surface from the depths of the river the teeth and bones of sharks and other animals of enormous size. Specimens of huge sharks teeth were exhibited.

Mr. Horace P. Smith read a paper on "Color Perception and Color Blindness," illustrated by colored diagrams on the blackboard, giving the latest scientific theories of the action of light on the optic nerve.

Pertinent to the subject Dr. Heighway spoke of the rapid and beautiful changes of color produced by the chameleon. He also spoke of the colors caused by the diffraction of light by ruled lines upon steel plates. These bands were ruled so delicately that 100,000 occupied but one inch.

Mr. Wm. Hubbell Fisher called attention to a work on Bird Colors, by Robert Ridgeway, containing a nomenclature of colors and a comparative vocabulary of color in different languages.

Dr. Dun stated that the railroad companies of Pennsylvania were required by law to examine certain employees, engineers, brakesmen, etc., annually, in regard to color perception, for it had been discovered that the defect of color blindness could be acquired unconsciously, where it had not before existed; yet cases had come to light where engineers had performed their duties for years without accident, who possessed this defect in a marked degree.

Dr. Christopher thought that so-called color blindness was often due to color ignorance—a lack of training in the knowledge of colors. He spoke of the difficulty of distinguishing the various colors of the stars. It was an interesting fact that many of the telescopic double stars showed complimentary colors.

A paper was read by title, by request, as follows: "A Preliminary Catalogue of the Amphibia and Reptilia of the State of Indiana, by O. P. Hay, M. A."

W. B. Carpenter was proposed for active membership.

Dr. N. E. Jones, of Circleville, Ohio, and Erasmus Gest, of New York City, were elected Honorary members, and Miss Susan Griffith and Dr. S. H. Collins, active members.

An election of Curators resulted as follows:

Curator of Geology, J. W. Hall, Jr.
" " Entomology, George B. Twitchell.
" " Botany, Miss Anna Brown.
" " Zoology, Dr. D. S. Young.

Curator of Osteology, Dr. O. D. Norton.
" " Anthropology, Dr. W. A. Dun.
" " Photography, D. W. Huntington.
" " Meteorology, Prof. G. W. Harper.
" " Microscopy, Dr. Charles E. Caldwell.
" " Physics and Chemistry, Dr. W. S. Christopher.
" " Ornithology, Charles Dury.
" " Conchology, Mrs. M. C. Morehead.

Donations for the month were as follows: From C. L. Faber, specimens agatized-wood and rough agates, gold ore, crystalized pulin wood, septaria, fluorite, opalized-wood, carnelian wood, chlorastrolite, amazon stone, natrolite, aragonite, silver ore, malachite, amethyst; from Davis L. James, Ohio Agricultural Report 1873, '77 and '78 (2 vols.), Ohio Railway Report 1874, Report of Department of Agriculture 1871, Ohio Statistics 1874, Land Office Report 1876; from Prof. P. Herbert Carpenter, Eton College, Note on Structure of Crotalocrinus, Carpenter (pamphlet); from Miss L. C. Smith, specimens of Marine Shells, Beetle.

Adjourned.

SCIENTIFIC MEETING, *June* 7, 1887.

President Skinner in the chair, twenty-three members present.

The minutes of May were read and approved.

The resignation of Mr. George Bullock, Member at Large of the Executive Board, was received and accepted.

Mr. Allen Collier resigned his membership in the society.

Dr. Walter A. Dun read his address as retiring President. His topic was "The Identification of the Utica Shales at Cincinnati." Sections of several of the deep wells recently drilled near Cincinnati were shown, and a large number of drillings from various wells exhibited.*

Mr. Davis L. James read a paper by Prof. Joseph F. James, of Oxford, Ohio, giving an account of a deep well recently drilled at Oxford. The drillers reached 1,345 feet, when the well was abandoned, with 180 feet of water in the hole.

The following persons were proposed for election to active membership:

John Monteith, Dr. T. A. Reamy, Warren T. Morehead, Dr. E. G. Betty, Miss Belle Woods, Miss Louise Stewart, Miss

* NOTE—Dr. Dun's paper will appear in a future number of this Journal.

Louise Horsely, Charles Schuckert, E. O. Ulrich, Charles P. Fennel, Dr. James G. Hyndman, Omar T. Joslin.

Mr. William B. Carpenter was elected to active membership.

The President appointed Rev. Raphael Benjamin and Davis L. James a committee to audit the Treasurer's accounts.

Dr. O. D. Norton suggested that some appropriate document of or relating to the society be handed to the Chamber of Com merce to be placed in the corner-stone of their new building. It was suggested and agreed that a number of the Journal be selected for that purpose.

Mr. William Hubbell Fisher offered the following amendment to the By-Laws:

"In the last clause of Section 1, Article VI of the By Laws, immediately after the word "active," insert the word "corresponding." The clause amended to read as follows: "Active, Corresponding and Life Members, and invited guests, only, shall be privileged to read papers before the Society."

It was announced that Dr. S. J. Mills, Mr. J. F. Woods, Mr. Mr. E. R. Quick and Mr. A. W. Butler had been nominated by the Executive Board for Corresponding membership.

Mr. Smith announced that arrangements had been made for an exhibition to be given by the Botanical and Microscopical sections of the Society, at the Museum, Tuesday, June 14th, at 8 P. M.

A vote of thanks was tendered the President, Mr Skinner, for securing for the use of the Society a copy of Audobon's Birds of America. The copy is to be loaned to the Society.

Donations for June were as follows: From Dr. W. A. Dun, Cecropia moth, precious garnets, sections of Freeman Ave. and Hemingray gas wells; from Louis A. Piatt, Newport, Ky., Nest of Oriole; from Dr. O. D. Norton, Vertebra of Megalodon, flint chips; from Prof. E. W. Claypole, Akron, O., Organic Variation Indefinite, not Definite in Direction (pamph.); from W. R. Lighten, Leavenworth, Kan., specimen of Camptosorus rhizophyllus; from Franklin Institute, through Mr. Wm. H Knight, miscellaneous publications of Institute; from Academy of Natural Science, through Mrs. Wm. H. Knight, miscellaneous publications of Academy; from Rev. Raphael Benjamin, Cecropia moth; from Baron F. Von Thumen, Gerz, Austria, Monograph, "Die Phoma Krank-

heit der Weinreben; from Prof. S. Lockwood, Freehold, N. J., Monograph, "Raising Diatoms in the Laboratory;" from Edw. R. Skinner and Dr. S. J. Mills, Toledo, O., Cast of Head found by Mr. Forbes in Florida; Paul Esselborn, Fossil Coral; from Dr. J. S. Neave, Dresden, O., specimen of Lepidodendron; from Dr. A. E. Heighway, Sr., specimens of tremolite and talc, wood bored by beetle.

Adjourned.

A PRELIMINARY CATALOGUE OF THE AMPHIBIA AND REPTILIA OF THE STATE OF INDIANA.

BY O. P. HAY, PH. D., *Corresponding Member Cincinnati Society of Natural History.*

(Read by title May 3rd, 1887.)

PREFACE.

The following Catalogue is designed to include all the species and varieties of Amphibians and Reptiles that are at present known to occur within the limits of the State of Indiana, and to give the ascertained geographical range of each form. Altogether seventy-seven species are enumerated. It is quite certain, however, that many additional species belong to our State. Several species for instance, have been taken at Mt. Carmel, Illinois, on the Wabash River, that have not yet been reported from Indiana. While probably the greater number, if not all, of such species also occur on the Indiana side of the river, we can not be sure of it until some one has seen them. It is greatly to be desired that persons fortunate enough to secure such species will report them and the place where they were captured. Correspondence and more especially specimens are solicited.

The principal sources of information in preparing this list are as follows: My own collection and that of Butler University; that in the State Geologist's office: a collection made during a period of several years at New Harmony, Ind., by the late James Sampson; the check lists of Prof. Cope and Dr. Yarrow: the writings of Agassiz. Cope and others; and a catalogue of the Reptiles and Amphibians of Franklin county by Mr. Edward Hughes. The opportunity to examine the State collection and the collection at New Harmony I owe to Prof. John Collett, at that time State Geologist. I am also indebted to Mr. C. H. Bollman, of the State University, for a list of species taken in Monroe county.

BUTLER UNIVERSITY, Irvington, Ind., May 30th, 1887.

Class AMPHIBIA.
Order URODELA.
Sub order PERENNIBRANCHIATA.
Family SIRENIDÆ.
Genus SIREN, Linn.

1. *Siren lacertina* Linn. MUD EEL; SIREN.
New Harmony (Sampson's coll.); Mt. Carmel, Ills. (Ridgway).

Family PROTEIDÆ.
Genus NECTURUS, Rafinesque.

1. *Necturus maculatus* Raf. MUD PUPPY; WATER DOG.

Found doubtless in all the larger streams of the State. Known localities: Wabash; New Harmony (Sampson's coll.); Franklin county (Hughes); Mt. Carmel, Ills. (Yarrow); Monroe county (Ind. Univ. coll.)

Sub-order CADUCIBRANCHIATA.
Family CRYPTOBRANCHIDÆ.
Genus CRYPTOBRANCHUS, Leuckart.

3. *Cryptobranchus alleghaniensis* (Harl.) V. d. Hoev. HELLBENDER.

Probably to be found in all the rivers and lakes of the State. Common everywhere along the Ohio River; Franklin county (E. R. Quick).

Family AMBLYSTOMIDÆ.

Genus CHONDROTUS, Cope (Amer. Nat. 1887, 87).

4. *Chondrotus microstomus* Cope. SMALL-MOUTHED SALAMANDER.

One of the most abundant species of the family about Indianapolis; New Harmony (Sampson's coll.); Wheatland (Ridgway).

Genus AMBLYSTOMA, Tschudi.

5. *Amblystoma jeffersonianum jeffersonianum* (Green) Cope. JEFFERSON'S SALAMANDER.

Apparently rare, but probably to be found in all parts of the State. One specimen has been captured at Irvington, another has been sent me from Franklin county by Mr. A. W. Butler, and others have been taken at Bloomington (Ind. Univ. coll.).

5*a*. *Amblystoma jeffersonianum fuscum* (Green) Cope. BROWN SALAMANDER.

Originally described from Hanover, Jefferson county.

6. *Amblystoma tigrinum tigrinum* (Green) Cope. TIGER SALAMANDER.

Very common about Indianapolis; probably to be found throughout the State.

7. *Amblystoma punctatum* (Linn.) Cope. SPOTTED SALAMANDER.

New Harmony (Sampson's coll.); Wheatland (Ridgway): Franklin county (Hughes): Shelby county (collected by G. H. Clarke); Monroe county (Ind. Univ. coll.).

8. *Amblystoma opacum* (Gravenh.) Cope. MARBLED SALAMANDER.

New Harmony (Sampson's coll.): Wheatland (Ridgway).

9. *Amblystoma copeanum* Hay. SHORT-BODIED SALAMANDER.

Known from a single specimen found at Irvington, and described in the Proceedings of the U. S. National Museum 1885, vol. viii. p. 207, pl. xiv.

Family SALAMANDRIDÆ.
Sub-family PLETHODONTINÆ.
Genus SPELERPES, Rafinesque.

10. *Spelerpes bilineatus* (Green) Baird. GREEN'S TRITON.

Common about Brookville, Franklin county (Hughes and A. W. Butler); Monroe county (Ind. Univ. coll.). Will doubtless be found at other points.

11. *Spelerpes longicaudus* (Green) Baird. LONG-TAILED TRITON.

Caves of Southern Indiana (Jordan): Brookville (Hughes, A. W. Butler); Monroe county (Ind. Univ. coll.).

Genus HEMIDACTYLIUM, Tschudi.

12. *Hemidactylium scutatum* Tschudi. SCALY SALAMANDER.

Distributed from Rhode Island to Illinois. Reported to be not uncommon about Brookville (Hughes). Known readily by having but four digits on the hinder feet.

Genus PLETHODON, Tschudi.

13. *Plethodon erythronotus* (Green) Baird. RED-BACKED SALAMANDER.

New Harmony (Sampson's coll.); Brookville (Hughes); Monroe county (Ind. Univ. coll.).

14. *Plethodon glutinosus* Green. SLIMY LIZARD.

Reported to be common in the vicinity of Bloomington, Monroe county (C. H. Bollman).

Sub-family DESMOGNATHINÆ.

15. *Desmognathus fusca fusca* (Rafinesque) Baird. BROWN TRITON.

A common species in Franklin county (Hughes, Butler); Monroe county (C. H. Bollman).

Sub-family SALAMANDRINÆ.

Genus DIEMYCTYLUS, Rafinesque.

16. *Diemyctylus viridescens* Raf. GREEN TRITON; NEWT.

New Harmony (Sampson's coll.); Brookville, very common, (Hughes); Mt. Carmel (Yarrow); Monroe county (Ind. Univ. coll.). Likely to be found throughout the State.

Order ANURA.

Sub-order PHANEROGLOSSA.

Family BUFONIDÆ.

Sub family HYLINÆ.

Genus HYLA, Laurenti.

17. *Hyla versicolor* LeC. COMMON TREE TOAD.

Found everywhere.

18. *Hyla pickeringii* Holbrook.

Three specimens have been found in the vicinity of Bloomington, (C. H. Bollman).

Genus ACRIS, Dum. & Bib.

19. *Acris gryllus crepitans* (LeC.) Cope. WESTERN CRICKET FROG.

Common about Indianapolis, and probably so along all our streams. Franklin county (Hughes); Monroe county (Ind. Univ. coll.).

Genus CHOROPHILUS, Baird.

20 *Chorophilus triseriatus triseriatus* (Wied.) Cope. STRIPED TREE FROG.

Probably generally, but not abundantly, distributed. One specimen secured at Irvington.

Sub-family BUFONINÆ.

Genus BUFO, Laurenti.

21. *Bufo lentiginosus americanus* (LeC.) Cope. TOAD.

Common everywhere.

Family RANIDÆ.
Sub-family RANINÆ.
Genus RANA, Linnæus.

22. *Rana halecina halecina* Kalm. LEOPARD FROG.
Common everywhere.

23. *Rana areolata circulosa* (Rice & Davis) Cope. HOOSIER FROG.
Benton county (D. S. Jordan, Manual of Vertebrates, 2d ed. 355).

24. *Rana palustris* LeC. SWAMP FROG.
Said to occur in Franklin county (Hughes); Monroe county, where it is abundant (Ind. Univ. coll.). Probably to be found throughout the State.

25. *Rana clamata* Daudin. GREEN FROG; SPRING FROG.
In all streams.

26. *Rana catesbeiana* Shaw. BULL FROG.
In all the larger streams.

27. *Rana sylvatica* LeC.
Moderately common. Irvington; Shelby county; Franklin county (Hughes); Monroe county (Ind. Univ. coll.).

Class REPTILIA.
Order OPHIDIA.
Sub-order ASINEA.
Family COLUBRIDÆ.
Genus CARPHOPHIS, Gervais.

28. *Carphophis helenæ* Kenn. HELEN'S SNAKE.
New Harmony, where it is common (Sampson's coll.); Monroe county (Ind. Univ. coll.); Brown county.

29. *Carphophis amœnus* (Say) Gerv. GROUND SNAKE; WORM SNAKE.
Wheatland (Ridgway), New Harmony (Sampson's coll.).

Genus VIRGINIA, B. & G.

30. *Virginia elegans* Kenn. VIRGINIA'S SNAKE.
A rare snake. Collected in Brown county by Mr. Charles Jameson. Has also been found at Mt. Carmel, Ills. (Yarrow).

Genus FARANCIA, Gray.

31. *Farancia abacura* (Holbrook) B. & G. RED-BELLIED HORN SNAKE.

A Southern snake that has been found at Wheatland, Knox county, by Dr. Robert Ridgway.

Genus OPHIBOLUS, B & G.

32. *Ophibolus doliatus doliatus* (Linn.) Cope. SCARLET HOUSE SNAKE.

New Harmony (Sampson's coll.); Brown county.

32*a*. *Ophibolus doliatus triangulus* (Boie) Cope. HOUSE, OR MILK SNAKE.

Throughout the State; common.

33. *Ophibolus getulus getulus* (Linn.) Cope. KING SNAKE.

One specimen in Mr. Sampson's collection, taken at New Harmony. Common in the Southern States.

33*a*. *Ophibolus getulus niger* Yarrow. RIDGWAY'S KING SNAKE.

Described from three specimens found by Mr. Robert Ridgway at Wheatland. Common about Mt. Carmel, Ills. (Yarrow).

Genus DIADOPHIS, B. & G.

34. *Diadophis punctatus punctatus* (Linn) B. & G. RING-NECKED SNAKE.

Probably to be found all over the State. New Harmony (Sampson's coll.); Franklin county (Hughes); Monroe county (Ind. Univ. coll.)

Genus CYCLOPHIS, Günther.

35. *Cyclophis vernalis* (DeK.) Günther. SMOOTH GREEN SNAKE.

Probably generally, but not abundantly, distributed. New Harmony (Sampson's coll.); Brown county (collected by Charles Jameson).

Genus PHYLOPHILOPHIS, Garman.

36. *Phyllophilophis aestivus* (Linn.) Garman. KEELED GREEN SNAKE.

New Harmony (Sampson's coll.); Dearborn county (A. W. Butler); Monroe county, where it is rare (Ind. Univ. coll.)

Genus COLUBER, Linn.

37. *Coluber emoryi* (B. & G.) Cope. EMORY'S SNAKE.

A species found in the South-western States and Mexico. Said to occur at Mt. Carmel (Yarrow); and in Franklin county (Hughes).

38. *Coluber vulpinus* (B. & G.) Cope. FOX SNAKE.

Widely diffused but not common. New Harmony (Sampson's coll.); Wheatland (Ridgway); Hamilton county.

39. *Coluber obsoletus obsoletus* Say. PILOT SNAKE: BLACK RACER.

Wheatland (Ridgway); Franklin county, common (Hughes); Monroe county (Ind. Univ. coll.)

40. *Coluber guttatus* Linn. SPOTTED RACER.

Brookville, Franklin county (Hughes); Mt. Carmel (Yarrow).

Genus BASCANION, B. & G.

41. *Bascanion constrictor* (Linn.) B. & G. BLACK SNAKE; BLUE RACER.

Found everywhere in the State.

Genus EUTÆNIA, B. & G.

42. *Eutænia saurita* (Linn.) B. & G. RIBBON SNAKE.

Wheatland (Ridgway); Franklin county (Butler). Doubtless throughout the southern half of the State.

43. *Eutænia faireyi* B. & G. FAIREY'S GARTER SNAKE.

New Harmony (Sampson's coll.); Mt. Carmel (Yarrow). This will probably prove to be but a variety of the preceding.

44. *Eutænia radix* B. & G. RACINE GARTER SNAKE.

A Western species extending into Indiana and Michigan. Mt. Carmel (Yarrow); Irvington.

45. *Eutænia sirtalis sirtalis.* GARTER SNAKE.

Abundant everywhere.

45*a*. *Eutænia sirtalis ordinata* (B. & G.) Cope. GRASS SNAKE.

Specimens that are referred to this variety are common about Indianapolis. Doubtless common throughout the State.

45*b*. *Eutænia sirtalis parietalis* (Say) Cope. RED SIDED GARTER SNAKE.

Not uncommon about Irvington.

Genus STORERIA, B. & G.

46. *Storeria occipitomaculata* (Stor.) B. & G. STORER'S SNAKE.

Probably generally distributed, but not abundant. Met with occasionally about Irvington; New Harmony (Sampson's coll.).

47. *Storeria dekayi* (Holb.) B. & G. DEKAY'S BROWN SNAKE.

More common than the preceding. Wheatland (Ridgway);

Lebanon (Yarrow); New Harmony (Sampson's coll.), Monroe county (Ind. Univ. coll.); Irvington.

Genus Tropidoclonium, Cope.

48. *Tropidoclonium kirtlandi* (Kenn.) Cope. Kirtland's Snake.
A very common species about Irvington; Monroe county (Jordan).

Genus Tropidonotus, Kuhl.

49. *Tropidonotus leberis* (Linn.) DeK. Brown Queen Snake.
Common in Franklin county (Hughes, A. W. Butler); Parke county (Ind. Acad. Sci.). Will probably be found in all parts of the State.

50. *Tropidonotus fasciatus* (Linn.) Schleg. Banded Water Snake.
Southern in its range, but found at Wheatland by Dr. Robt. Ridgway.

51. *Tropidonotus sipedon sipedon* (Linn.) Holb. Water Snake.
Abundant in all our streams.

52. *Tropidonotus rhombifer* (Hall.) B. & G. Holbrook's Water Snake.

Very common at Wheatland (Ridgway); Lafayette (Yarrow); New Harmony (Sampson's coll.).

Genus Heterodon, Beauvois.

53. *Heterodon platyrhinus platyrhinus* Latr. Hog-nosed Snake; Spreading Adder.

May occur throughout the State; more common in southern half. Abundant about New Harmony (E. Thrall and Sampson's coll.); common about Brookville (Hughes); Vernon, Jennings county (J. Cope); Monroe county (Ind. Univ. coll.)

53*a*. *Heterodon platyrhinus niger* (Troost) Yarrow. Black Viper.
New Harmony (E. Thrall); Clay county (State coll.); Brown county (coll. Chas. Jameson).

54. *Heterodon simus simus* (Linn.) Cope. Sand Viper.
Brookville, Ind. (Hughes and Yarrow). Probably elsewhere in southern portion of the State.

Suborder SOLENOGLYPHA.

Family CROTALIDÆ.

Genus Ancistrodon, Beauvois.

55. *Ancistrodon contortrix* (Linn.) B. & G. Copperhead.
Originally distributed over probably the greater part of the

State, now happily exterminated in the most densely inhabited districts. New Harmony (E. Thrall and Sampson's coll.); Monroe county (Ind. Univ. coll.); Veedersburg, Fountain county.

Genus CAUDISONA, Laurenti.

56. *Caudisona tergemina* (Say) Wagler. MASSASAUGA. PRAIRIE RATTLESNAKE.

Over the northern half of the State. La Porte county (State coll.); Hendricks county (M. B. Harvey); Hamilton county (Dr. H. Moore).

Genus CROTALUS, Linn.

57. *Crotalus horridus* Linn. BANDED, or TIMBER, RATTLESNAKE.

Generally distributed in wooded districts, but becoming rare. New Harmony (Sampson's coll.); "variety *atricaudatus*" from "Indiana" in State collection; Monroe county (Ind. Univ. coll.)

Order LACERTILIA.

Family SCINCIDÆ.

Genus OLIGOSOMA, Girard.

58. *Oligosoma laterale* (Say) Grd. BROWN-BACKED GROUND LIZARD.

Wheatland (Ridgway).

Genus EUMECES, Wiegmann.

59. *Eumeces fasciatus* (Linn.) SCORPION; BLUE-TAILED LIZARD.

Probably throughout the State. Known localities: Brookville (Hughes); New Harmony (Sampson's coll); Monroe county (Ind. Univ. coll.); Irvington.

Family ANGUIDÆ.

Genus OPHISAURUS, Daudin.

60. *Ophisaurus ventralis* (Linn.) Daudin. GLASS SNAKE; JOINT SNAKE.

This interesting snake-like lizard may be expected to occur anywhere along the western border of the State. Warren county (Prof. John Collett).

Family IGUANIDÆ.

Genus SCELOPORUS, Weigmann.

61. *Sceloporus undulatus* (Harl.) Fitz. ALLIGATOR LIZARD. Rather abundant about Brookville (Hughes); rare about Bloomington (Ind. Univ. coll.)

Order TESTUDINATA.
Family TRIONYCHIDÆ.
Genus AMYDA, Agassiz.

62. *Amyda mutica.* (Le S.) Ag. LEATHERY TURTLE.
Delphi (Agassiz); Madison and Mt. Carmel (Yarrow).

Genus ASPIDONECTES, Wagler.

63. *Aspidonectes ferox* Wagler. FIERCE SOFT-SHELLED TURTLE.
Madison (Yarrow). May be looked for elsewhere along the Ohio River.

64. *Aspidonectes spinifer* (Le S.) Ag. SPINY SOFT-SHELLED TURTLE.
Our commonest species of soft shelled turtle. Everywhere in the State.

Family CHELYDRIDÆ.
Genus CHELYDRA, Schweigger.

65. *Chelydra serpentina* (Schw.) Cope. SNAPPING TURTLE.
In all the waters of the State.

Genus MACROCHELYS, Gray.

66. *Macrochelys lacertina* (Schw.) Cope. ALLIGATOR SNAPPING TURTLE.
A large and fierce turtle living especially in the rivers of the Southern States, but which has been found much further north. Two specimens in the National Museum were sent from Northville, Mich. (Yarrow). Has been taken in the Wabash River just north of Mt. Carmel (H. Garman).

Family CINOSTERNIDÆ.
Genus AROMOCHELYS, Gray.

67. *Aromochelys odorata* (Latr.) Gray. MUSK TURTLE.
Throughout the State, but rare. Brookville (Hughes); Mt. Carmel (State coll.); La Porte and Kankakee marshes (Dr. G. M. Levette).

Family EMYDIDÆ.
Genus PSEUDEMYS, Gray.

68. *Pseudemys hieroglyphica* Holbrook. HOLBROOK'S TERRAPIN.
A very rare turtle. There is a specimen in the State collection from Mt. Carmel, Ills.

69. *Pseudemys troostii* (Holb.) Cope. TROOST'S TERRAPIN.
Wheatland (Ridgway). Another rare species.

70. *Pseudemys elegans* (Wied.) Cope. ELEGANT TERRAPIN.
A very common species in the Lower Wabash. New Harmony (Sampson's coll).

Genus MALACOCLEMMYS, Gray.

71. *Malacoclemmys geographicus* (Le S.) Cope. GEOGRAPHICAL TURTLE.
Common in all our streams.

72. *Malacoclemmys lesueurii* (Gray) True. LE SUEUR'S TERRAPIN.
Throughout the State. New Harmony (Sampson's coll.); Brookville (Hughes): Monroe county (Ind. Univ coll.)

Genus CHRYSEMYS, Gray.

73. *Chrysemys picta* (Herm.) Gray. PAINTED TURTLE.
Probably here and there throughout the State. Mt. Carmel (Yarrow); Brookville—common (A. W. Butler).

74. *Chrysemys marginata* Agassiz. MARGINED PAINTED TURTLE.
More common than the preceding. Mt. Carmel (Yarrow), Brookville (Hughes); Delphi (Agassiz); Monroe county (Ind. Univ. coll.); Indianapolis.

Genus CHELOPUS, Rafinesque.

75. *Chelopus guttatus* (Schw.) Cope. SPOTTED TURTLE.
An Eastern species that has been found by Dr. G. M. Levette to be rather common about La Porte and in marshes of Kankakee River.

Genus EMYS,[1] Brong.

76. *Emys meleagris* (Shaw) Cope. BLANDING'S TERRAPIN.
Found occasionally in Northern Indiana; Steuben county (Dr. Levette).

Genus CISTUDO, Flem.

77. *Cistudo carolina carolina* Linn. BOX TORTOISE.
Probably to be found in all parts of the State, but more common in the Southern portion. Abundant about New Harmony (Sampson's coll.); Brookville (A. W. Butler); Monroe county (Ind. Univ. coll.); Jefferson county.

ACCOUNT OF A WELL DRILLED FOR OIL OR GAS AT OXFORD, OHIO, MAY AND JUNE, 1887.

By Joseph F. James, M. Sc., *Professor of Geology and Botany in Miami University.*

(Read June 7th, 1887.)

The prevailing fever in Ohio and Indiana at the present time, is for searching the earth's crust for natural gas, or for oil. Scarcely a town of any size in Western Ohio or Eastern Indiana but has the fever. The result has been the expenditure of an immense amount of money, aggregating millions of dollars, and a considerable addition to the stock of knowledge of the geological structure of this part of the world. We are familiar, through Prof. Orton's "Report on Petroleum and Inflammable Gas of Ohio," with many facts connected with the oil and gas regions of Northwestern Ohio; but since this report was issued, many new wells have been bored, and new facts are constantly being brought to light. A good opportunity has lately been afforded the writer to study the strata of southwestern Ohio, by means of samples secured from a well drilled by the Oxford Gas and Oil Company. The present paper deals with the results of this drilling.

The place selected for the well is close to the Oxford station on the C. H. & I. R. R., 39 miles from Cincinnati, and about 900 feet above the sea level, and therefore about 465 feet above low water mark in the Ohio River at Cincinnati. The drill penetrated the soil and drift, composed of gravel, sand, and water worn rocks, to a depth of about forty feet, possibly more, for a fragment of water worn limestone came from a depth of forty-eight feet, though this may have fallen from above.

Immediately below the drift the bed rock was struck. This consisted of layers of solid blue limestone, such as are met with in various exposures at the surface, inter-stratified with beds of indurated clay or shale at various depths. The rock came up generally in small, angular fragments, often of the size of peas,

sometimes larger, but in all cases in such condition as to be recognized as the true blue limestone of the Cincinnati Group. At a depth of 302 feet a small vein of gas was struck. This, when lighted, blazed up to a height of from ten to twelve feet, but it soon went out, and, as it accumulated from time to time, was lighted to gratify the curiosity of on-lookers.

The limestone continued to the depth of four hundred feet, and was succeded by a bed of exceedingly compact, blue shale. This came up in small fragments, seldom as large as a grain of corn, and showed no change of character for 380 feet. Then, at a depth of 780 feet, there was struck a stratum of exceedingly hard, dark, almost black limestone, which the drill penetrated but slowly, the upper part being pierced at the rate of only three feet in two and a quarter hours. Lower down it was less hard, but still more compact than the blue limestone above had been. The fragments came to the surface very finely ground up, the pieces seldom larger than wheat grains. This rock continued for fifty feet, and is the only one in the scale which can be referred to the Utica slate of New York. It is very similar to the rock exposed at a low level at Cincinnati or above the city, and is probably the same as that referred to by Prof. Orton as being of Trenton age.* If it be the Utica Slate it is two hundred and fifty feet less in thickness than that found at Findlay.

That this marked the end of one and the beginning of another formation was evident from the specimens taken from 835 feet, for these were a whitish limestone, a rock evidently foreign to the surface of the State, and the probable equivalent of the Birdseye Limestone of New York. This continued with scarcely any variation to the depth of 1115 feet, when it became darker. From this down to about 1280 feet, there were alternate bands of dark and light material. Magnesia was found in all the samples tested. At 1255 feet there was a strong smell of petroleum as well as at 1265 and 1295 feet.

At 1280 feet there was an evident change. The rock became much darker and coarser. It had a perceptable greenish hue at 1295 feet, with a strong smell of oil. At 1300 it was blueish but also coarse. At 1312 to 1315 it was very coarse, with light colored and blue fragments intermingled. The blue contained many particles of iron pyrites. At 1320 it was very fine. At 1325 it was coarser, the white fragments effervescing readily with cold muriatic

*See second edition of "Petroleum and Inflammable Gas of Ohio."—Columbus 1887.

acid, showing it to to contain considerable carbonate of lime. But at 1330 there was another change. The rock was decidedly arenacious and effervesced readily with hot acid only, showing a considrable per cent. of magnesia. The drillers called it "sand," and to the eye it presented that appearance. As the drill went on to 1340, 1350, 1360 feet the material came up more and more finely ground up, and more and more like sand. When 1365 feet had been struck, and the drill was pulled out, the rope showed the presence of about 180 feet of water in what had previously been a a dry hole. A strong smell of sulphuretted hydrogen pervaded the air, and inspection of the water showed it to be sulphur water or Blue Lick. The material in this water was very finely ground up, and resembled flour more than anything else. It was a dark blue when wet, but changed on drying and on exposure to the air to white.

The 45 feet between 1280 and 1325 marked the base of the Trenton, and this may possibly be referable to the Chazy of New York geologists. But the white, sandy rock beneath it, could be referred to nothing but the Calciferous Sandrock which, in the ordinary scale, lies below the Trenton. The presence of water in the well will probably prevent its being bored deeper, unless indeed it is so cased that the water is shut out.

The section thus made shows the depth of the Trenton limestone in this part of the State. With the exception of changes in color, from light to dark, there was little difference in the rock for about 450 feet. This is a magnesian limestone, its presence shown by blow pipe tests made by Mr. Nelson Perry, Mining Engineer. But the forty-five feet below the light colored rock was very different, while that found still lower was more distinct still. Allowing a few feet for discrepancies, it may be said with confidence that the Trenton formation here is about five hundred feet thick.

Comparatively few fossils were found in the drillings. A specimen of *Monticulipora o'nealli* was found at 375 feet. Fragments of *Orthis*, *Zygospira*, etc., at 96 feet. Another fragment of *Orthis* from 790 feet, and a fragment of coral, unidentified, from 1212 feet. The subjoined notes on the specimens from different depths will indicate the character of the rocks more particularly. These samples are from eighty-seven different depths, and represent quite completely the changes in the strata.

Notes on specimens saved from various depths in the Oxford, Ohio, well, bored May and June, 1887.

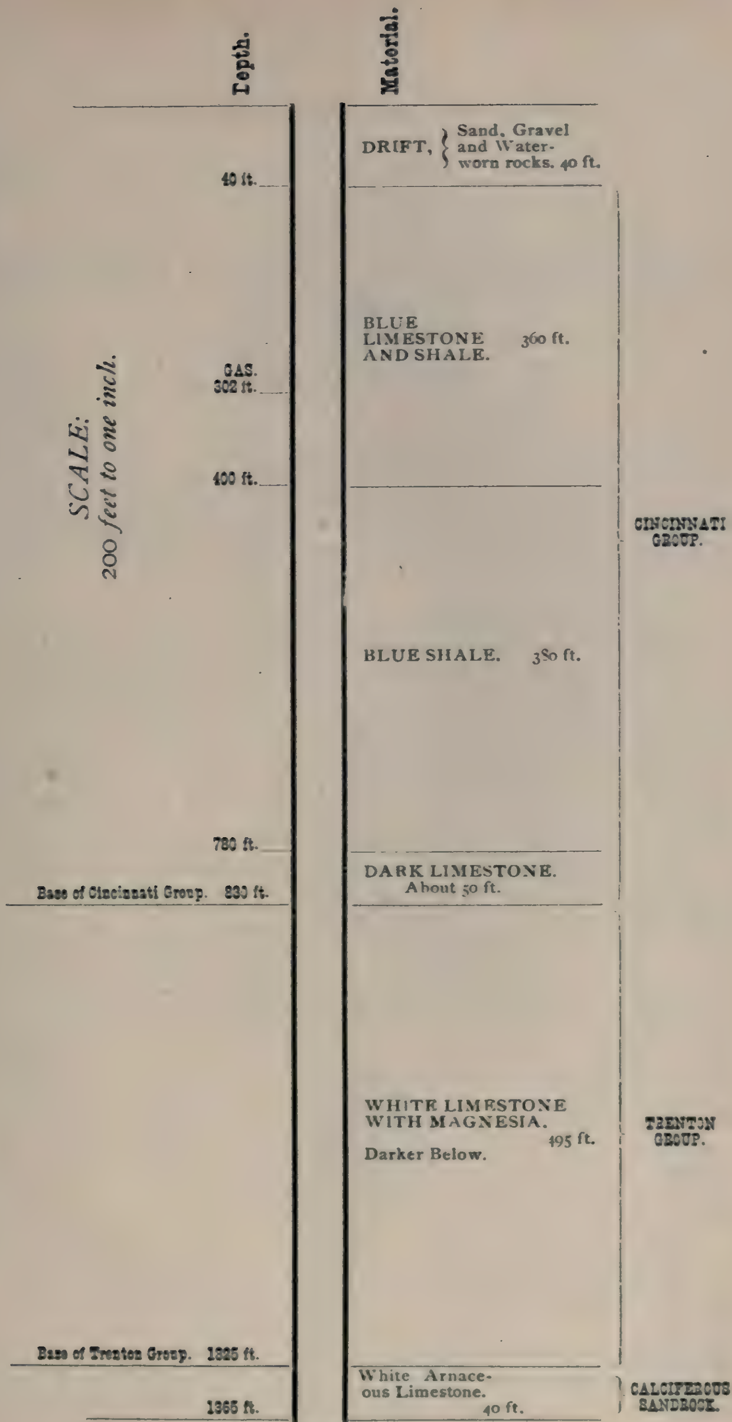
37	feet.	Piece sand stone.	Drift 40 to 50 feet.
48	"	" limestone; water worn.	
59	"	Large fragment, hard blue limestone.	Limestone and Shale About 360 feet
96	"	Fragments of hard limestone with fossils, *Orthis biforata*, (young), *O. testudinaria*, *Zygospira modesta*.	
160	"	Limestone.	
205	"	" with fragments of Asaphus.	
230	"	Limestone and clay.	
235	"	" "	
240	"	" " with fragment of Monticulipora.	
248	"	Limestone.	
253	"	"	
258	"	"	
260	"	"	
265	"	" and shale.	
305	"	" "	
380	"	"	
410	"	Blue Shale.	Blue Shale about 380 feet.
585	"	" "	
595	"	" "	
610	"	Blue shale.	
680	"	" "	
750	"	" "	
775	"	" "	
787	"	Dark limestone, soft at top, 5 feet drilled in ¾ hours; some shale.	Dark Limestone. Division between Cincinnati Gr. and underlying Trenton, 50 feet.
790	"	Dark limestone, with lighter particles and small amount of shale. Hard. Three feet drilled in 2¼ hours; fragments of *Orthis*.	
810	"	Same as above, finely ground up. Pieces about the size of wheat grains.	
830	"	Same but darker.	

835	"	White crystalline limestone fragment.	White Magnesian Limestone. Birdseye (?) Limestone.
850	"	Same, finely ground up, with pieces of darker grain, friable. Magnesian.	
855	"	Same, very friable—fragments larger—no fossils.	
875	"	Same, with pieces of greenish shale. Magnesian.	
881	"	Same, harder. 5 feet drilled in 4 hours.	
890	"	Same, finely ground up—little shale.	
900	"	Same, friable—pieces almost talcose—finely ground up. Magnesian.	
906	"	Slightly darker; fragments iron pyrites. Magnesian.	
930	"	Lighter color.	Trenton Magnesian (Birdseye Limestone.)
950	"	Same as above. Magnesian.	
965	"	" as 930.	
980	"	Almost white.	
1000	"	A little darker than above.	
1010	"	Same as 1000.	
1015	"	" "	
1025	"	" "	
1035	"	" " Magnesian.	
1045	"	" "	
1050	"	Nearly white.	
1060	"	A little darker.	
1075	"	Same as 1060. Magnesian.	
1080	"	" "	
1085	"	" " Finely ground.	
1110	"	" " Three small pieces. Crystalline. Magnesian.	
1115	"	Darker, much larger fragments. More Magnesian.	
1120	"	Same as 1115.	
1135	"	" " but pieces smaller.	
1140	"	Much lighter color, smaller pieces. Magnesia and Alumina.	
1150	"	Dark—hard—finely ground.	
1164	"	" " pieces larger. Magnesia and Alumina.	
1173	"	Lighter than above.	
1184	"	Same as 1173.	

1189 feet.	Like 1150.	Trenton. Magnesian. (Birdseye Limestone) 450 feet.
1195 "	" 1189.	
1200 "	" "	
1212 "	Darker, finely ground. Fragment of coral.	
1230 "	Much lighter, almost like 1000 feet.	
1240 "	Nearly same as above.	
1245 "	Darker, like 1212.	
1250 "	Lighter, " 1240.	
1255 "	Same as above. Strong smell of oil.	
1260 "	Same as 1255. Smell of oil.	
1265 "	" " "	
1280 "	Much darker and coarser. Evident change in rock.	Division between Trenton and Calciferous, 45 feet. (Possibly Chazy).
1290 "	Same as 1280.	
1295 "	Coarse, with a greenish hue. Smell of oil.	
1300 "	Coarse with bluish hue.	
1305 "	Same but lighter. Magnesian.	
1312 to 1315	Very coarse, light colored and blue fragments.	
1320 "	Very fine, bluish.	
1325 "	Coarser. Blue and white argillaceous! Effervesces with cold acid.	
1330 "	Coarse white rock. Arenaceous! Effervesces with hot acid only.	Calciferous Sandrock.
1340 "	Finer, white with a few darker fragments.	
1345 "	Coarser. White and Blue. Iron pyrites.	
1350 "	Very fine, white. Arenaceous; minute specks of blue.	
1355 "	Finer, white. (2 P. M.)	Calciferous Sandrock 40 feet.
1360 "	" still: white (4 P. M.)	
1365 "	Still finer: white, almost paste like, strong smell of sulphuretted hydrogen. 180 feet of water when pumped. (7 P. M.)	
1360 to 1370	Same material with small fragments of soft bluish rock. Water increasing.	

SUMMARY—

Drift	40 feet.
Limestones and Shales of the Cincinnati Gr.	790 "
Limestones of Trenton Group. (Birdseye and Chazy).	495 "
Calciferous Sandrock.	40 "
TOTAL.	1365 "



BLUE LICK WATER.

Section of strata penetrated by the Oxford, O., Gas and Oil Company's well.
Prepared by Jos. F James, M. Sc., Professor of Geology and Botany in Miami University.

NOTES ON TERTIARY FOSSILS, WITH DESCRIPTIONS OF NEW SPECIES.

BY TRUMAN H. ALDRICH.

(Read by title, December 7th, 1886)

I.

The following notes upon some imperfectly known or described fossils are here given, and are based upon careful examinations of the types or perfectly authenticated specimens. The list of Texas species is given from specimens in my cabinet, a few new species of especial interest are also described herein.

PLANARIA NITENS, Lea.

This minute shell was first described in the "Contributions to Geology," 1833, and was placed in the genus *Planaria*, Brown, with doubt. Finding that the genus itself was founded on young specimens of *Planorbis* (See Jeffrey's British Conchology, vol. iv, p. 68), it was necesary to find where this species really belonged. It is evidently the *embryonic* shell of *Solarium*, and can be clearly seen on many specimens of this genus, belonging to different species, especially on well preserved specimens. My cabinet contains a specimen with part of the adult whorl attached to the reflected lip ; also, a specimen worked out from *Solarium meekianum* Gabb (see wood cut,) equal to the form described as *Planaria nitens*, Lea., and a further specimen from Jackson, Miss., containing half a whorl of adult *Solarium* attached to the embryonic shell.

1

Nucleus of *S. meekianum*, Gabb, equal *Planaria nitens* Lea, from Wheelock, Texas.

Whenever the genus *Solarium* is found this little shell also appears, when searched for.

TURBONILLA [CHEMNITZIA] TRIGEMMATA, Con.

This species was first described in 1860, under the above name, but in 1865 (vol. 1, p. 27, Am. Jour. Conch.), a new

generic name, without description, was given and the specific name altered to "trinodosa." The form is catalogued as:

COMPSOPLEMA TRINODOSA, Con. The examples collected in Alabama belonging to my cabinet have lately been examined by Prof. W. H. Dall, who says in letter, "Both Mr. Stearns and myself refer the *Turbonilla trigemmata*, Con. to the *Strepomatidæ*. It belongs to a group of living forms like *Goniobasis hallenbeckii*, Lea, *G. boykiniana—postellii*, *floridensis*, etc., of the same author. It has nothing to do with *Scalaria*."

Having lately discovered two species of Physa described below, associated in the same beds with the above species, I am disposed to accept the opinion of Messrs. Dall and Stearns as correctly placing the above shell. It should be known as *Goniobasis trigemmata* Con sp.

OSTREA PANDIFORMIS, Gabb.

This fossil was described as cretaceous, because it was received from a black prairie near Yazoo City, Miss. This locality is not Cretaceous but Tertiary, and a part of the Jackson group. We also have it from Shubuta, Miss., and is rather common in the strata holding Zeuglodon bones. It closely resembles an old and large *O. mortonii*, Gabb (*panda pars*). Specimens in my cabinet are six inches broad from beak to ventral margin. It seems to have been known to Prof. Tuomey, and was called *Gryphæa mutabilis* by him. *Ostrea tuomeyi* Con. (Proc. Acad. Nat. Sciences, p. 184. 1865,) is evidently the same form. It is quite probable that all three names will have to be placed in the synonymy of *Ostrea mortonii*, Gabb, (*panda pars*).

Prof. R. P. Whitfield (Am. Jour. Conch. pp. 259-268, pl. 27, 1865) described from the collection of Prof. James Hall, a number of new Eocene forms, but did not give figures of all of them. They were mostly collected by the late Rev. T. J. Hale when a resident of Mobile, Ala. Through lapse of time aud several moves there have crept in some errors of locality. By the courtesy of Prof. James Hall and the kindness of Mr. C. E. Beecher, I have been allowed to examine most of the original types, and have had those not heretofore figured drawn for future publication in the Alabama State Survey Bulletins.

The following notes are prepared from the type specimens or examples compared with them:

1. PISANIA CLAIBORNENSIS, Whitf'd.

This form is undoubtedly *Ranella maclurii*, Con. There are

several slight differences which should be noted. The type is broader and shorter than ordinary specimens, but the canal appears to be worn, the revolving lines are the same, the outer lip the same, and both forms have the same number of whorls. In the type no varices appear on the body whorl or the next preceding, but are present on all the others. This variation also occurs in specimens in my cabinet.

Conrad made a new genus to accommodate this shell "Ranellina"; but it must also be expunged, as the species is a typical *Triton.* No specific or generic description was ever published by Conrad, but he figured the species under his name in No. 3, 2d ed. of his Fossil Shells of the Tertiary. Pl. 18, fig. 9, 1835.

2. Fusus tortilis, Whitf'd.

This species has the form of typical *Fusus* in its long straight canal but the folds (two in number) upon the columella must remove it to *Fasciolaria*, the straight canal makes even this opposition doubtful. The locality where the type is most abundant is Mathews Landing bed, Alabama, in the lower Tertiary.

3. Pseudolira elliptica, Whitf'd.

The locality given by Whitfield is no doubt incorrect. The shell is described from a single specimen. An examination o' the contents of the interior of the type showed a light colored sand exactly similar to that in my specimens collected from Bells Ldg., Alabama, on the Alabama River. The type is a half grown form.

4. Monoptygma leai, Whitf'd.

This very handsome species of the genus, instituted by the late Isaac Lea, is only known from the lower Clairbornian beds at Lisbon Ala., and should be located in this horizon by the similarity of the very peculiar sand found in the types. The specimen figured is a young shell; examples over two inches long are in my possession.

5. Mitra haleanus, Whitf'd.

Is also from Lisbon Ala., a young shell used as the type contains Lisbon sand. It is probably a Volute.

6. Mitra biconica, Whitf'd.

Occurs at Lisbon Ala., in Miss., and in Texas. It is a Pleurotomid and should be put into the subgenus *Cordiera* Ronalt.

7. Cerithium vinctum, Whitf'd. Is also a Lisbon species. The figured type is a young shell and badly worn. The mature form

from the Claiborne ferruginous sand has been described as *Rostellaria whitfieldi*, Heilpr.

The typical lot consists of four specimens all poorly preserved, and the locality is determined by the contents as before. The Lisbon collections of Mr. Hale were evidently labelled "Vicksburg" by mistake. The figure given by Whitfield is misleading as to the suture, though the description is correct. This species should be retained as a Cerithium.

8. TURRITELLA EURYNOME Whitf'd., is equal to *T. multilira* and both only vareties of *T. humerosa* Con., which also includes my *T. bellifera*, (This Journal, Vol. 8, July, 1885).

9. VELUTERIA EXPANSA, Whitf'd.

Prof. Whitfield informs me this species was obtained from the dirt out of a large *Volute newcombiana*, Whitf'd., as the only locality for this species is at Bells Landing, the habitat of this form is fixed. The species has a *very* suspicious resemblance to a very young or embryonic *Infundibulum trochiformis*, Lam.

All the localities given in this paper of Prof. Whitfield's seem to be mixed, judging by my own collections, and as Hale considered the Tertiary much thinner than it turns out to be, he may have mistaken different beds and misplaced the fossils. Some of the early Alabama collectors would not always give their exact locality because it was considered of but little importance.

II.

As a contribution towards the Eocene paleontology of Texas the following species received from Dr. F. L. Yoakum collected near Palestine, Texas, are here given. The material consists of a rather soft red clay holding a large amount of Iron known as the "Iron Strata" and also a bright green indurated material very much like "Burrstone" in some of its various forms.

From the Iron Strata we have:

Venericardia mooreana, Con.
Ostrea divaricata, Lea.
" sellæformis, Con.
Nucula ovula, Lea.
Anomia ephippioides, Gabb.
Astarte sulcata, Lea. var.
Crassatella antestriata, Gabb.
" sp? (Cast.)

Cytherea, sp? (Cast.)
Leda sp? (Cast.)
Tellina mooreana, Gabb.
Leda media, Lea,
" compsa, Gabb.
Pleurotoma 2 sp.
Rostellaria velata, Con.
Turritella sp.
Turbinolia pharetra, Lea.

From the "Green stone."

Umbrella planulata, Con.

(A young specimen but not distinguishable from the Jackson form).

Erato semenoides, Gabb.
Agaronia punctulifera, Gabb.
Corbula texana, Gabb.
Neverita arota, Gabb.
Phos texanus, Gabb.
Limopsis declivis, Con.

The occurence of the Jackson form of Umbrella in the strata associated with forms heretofore supposed to be Claibornian is certainly calculated to impress one with how little is known of the distribution of the fossils of the Tertiary.

III.

DESCRIPTIONS OF NEW SPECIES.

DOSINIA MERCENAROIDEA, n. sp.

Shell orbicular, moderately compressed, concentrically finely striated, nearly smooth upon the umbo. Substance of the shell thin, thickening towards the margins; lunule rather long and narrow, beak curved towards lunule, small and anterior to the centre; hinge line rather long. Teeth in left valve prominent, erect, central one subtriangular. Ventral margin smooth.

Length $1\frac{4}{10}''$, Breadth $1\frac{15}{100}''$, Thickness $\frac{6}{10}''$

Locality: Upper landing at base of Claiborne Bluff. (My No. 9 bed Claiborne Section).

This species is more rotund than the recent *D. concentrica* Gmel. and much thicker through the umbones. Only two specimens found.

SIGARETUS (SIGATICUS) CLARKEANUS, n. sp.

Shell rather thick, rotund, whorls five, suture linear, surface of body whorl with a large number of impressed lines almost obsolete in the centre but numerous and distinct above and below: umbilicus striate within: aperture lunate, inner lip covered with a callus, thickening towards the posterior part.

Locality: Choctaw Corner and Hatchetigbee Bluff, Ala.

This peculiar shell posesses the form of *Natica*, but the lines of *Sigaretus*. It constitutes a second species of the subgenus.

PHYSA CHOCTAVENSIS, n. sp.

Shell thin, minute, rather obtuse and broad, whorls probably five, somewhat shouldered, outer lip slightly patulous, inner lip reflected and reaching well upon the body wall, surface showing lines of growth only.

Locality: Choctaw Corner, Ala., Woods Bluff Group.

Resembles somewhat very young specimens of the common *Physa heterostropha*, Say, but presenting differences enough to constitute a distinct Species.

Five specimens found.

PHYSA ELONGATOIDEA, n. sp.

Shell thin, minute, strongly sinistral. whorls five, smooth, suture strongly impressed and very oblique to the axis, aperture almost quadrate, inner lip meeting the parietal wall abruptly and reaching down nearly straight.

Locality same as previous species.

This form is peculiar in departing from the American living types and being more elongate than any here known. It might be mistaken for a species of Limnea if it was not sinistral. The only specimen found is a young shell.

MATHILDA CLAIBORNENSIS, n. sp.

Shell very minute, embryonic whorls three, and placed as usual in the genus, the adult whorls, (but three remaining in the type) with three rounded smooth ring like bands, the intervening spaces having impressed longitudinal lines which do not pass over the bands.

Locality: Claiborne Ferruginous Sand.

Very rare, but the second species known from this famous deposit.

REPORTS OF THE OFFICERS OF THE SOCIETY SUBMITTED AT THE ANNUAL MEETING, APRIL 5, 1887.

SECRETARY'S REPORT. (Abstract.)

The usual meetings for the year—one each month—have been held, and three special meetings, viz: 1st. April 16th, for the discussion of the value of the granite proposed to be used for paving our city streets. At this meeting Prof. Geo. W. Harper read a suggestive paper, which was followed by a free discussion of the subject. 2nd. May 25th, for the reading of papers on the destruction of "Our Native Birds." Messrs. Chas Dury, Wm. Hubbell Fisher and Reuben H. Warder read papers. 3rd. June 16th, upon which occasion papers were read by Mr. Chas. Dury, Mr. Fisher and Prof. Jos. F. James, replying to a paper read by Dr. F. W. Langdon at the regular society meeting, in which he reviewed the papers of May 25th.

The attendance at regular meetings showed an average increase of 20 per cent.

Sixteen (16) papers were presented during the year, and 46 active and one honorary member elected.

Respectfully submitted, DAVIS L. JAMES,
Secretary.

TREASURER'S REPORT.

Annual Report of the Treasurer of the Cincinnati Society of Natural History for the year ending April 1, 1887:

Receipts.

Dues received during the year	$466 25	
Initiation fees	175 00	
	$641 25	
Sales of Journal	28 28	
Subscription for purchase of shells	31 00	
Interest on investments	2,507 93	
Total income		$3,208 46
Loans collected		15,100 00
Balance on hand April 1, 1886		871 07
		$19,179 53

Payments.

Custodians' salaries	$800 00
Janitor's wages	496 00
Publishing Journal	504 95
Expended for Museum	173 85
Expended for Library (mostly book-binding)	54 00
Furniture and repairs	343 82
Fuel, gas and water	117 26
Expense of Lectures	102 95
General expenses, printing, stationery, postage, Custodian's sundries, legal services, etc.	273 91
	2,866 74
New Loans on Mortgage	14,500 00
Balance on hand	1,812 79
	19,179 53

Number of members paid up to date	121
Number of members owing for one year or less	28
Number of members owing for two years	4
Number of members resigned or withdrawn during the year,	15
Number of members deceased	2
Number of new members elected during the year	46
Of these 33 perfected their membership by paying initiation fees	33
Leaving who have not paid	13

Of the resident members *nine* have become life members by the payment of the sum required by the by laws. There are a few other life members, of whom the treasurer does not keep a record, they having become such by virtue of having been officers of a former society, of which this society is the heir.

S. E. Wright, *Treasurer.*

CUSTODIAN'S REPORT.

Officers and Members of the Cincinnati Society of Natural History.

Ladies and Gentlemen:—I have the honor to submit herewith my first report as Custodian of the Cincinnati Society of Natural History.

I would first acknowledge the kindness of my predecessor, Prof. Jos. F. James, in instructing me in the various duties of the

office, and in the general arrangement of the museum. The duties of the office were formally assumed by me Aug. 1, 1886, and the progress made since that date will be indicated in the report.

Suffice it to say that the motive of every action has been to promote the interests and welfare of the Society, and if mistakes have been made, they have been errors of judgment and not of motive. The work of cataloguing and arranging specimens in the collection has been pushed forward as rapidly as circumstances would permit. About 1200 additions to the collection have been entered in the several departments. In addition to the regular accession catalogue, the card catalogue of each department has been kept up to date, so it is not difficult to ascertain whether any particular specimen is to be found in the museum or not.

The number of specimens in all the departments of the museum is constantly increasing, the additions coming through exchanges and donations. The entire number of specimens now catalogued is 6400 and several hundred are still uncatalogued.

Several exchanges which bring valuable additions to the collection are now in progress: of these may be mentioned the following; Mrs. R. W. Summers, San Luis Obispo, Cal., Conchology and Botany, Mr. Harry E. Dore, Portland, Oregon, Conchology; Mr. A. Freed, Lancaster, O., Geology and Botany; Mr. Henry Moores, Columbus, O., Palæontology; Prof. W. R. Lazenby, Columbus, O., Botany; Miss Alice Little, Dresden, O., Botany; Mr. Streator, Garrettsville, O., Conchology; M. Arturo Bofill, Barcelona, Spain, Conchology; Mr. T. H. Aldrich, Conchology.

Donations have heen quite liberal, from members and non-members.

The following members have contributed to the collection during the year: Dr. O. D. Norton, Dr. W. A. Dun, Mr. C. L. Faber, Dr. F. W. Langdon, Mr. A. P. Morgan, Mrs. U. P. James, Mr. Jacob S. Burnet, Mr. Davis L. James, Mr. Wm. H. Knight, Mr. U. P. James, Mr. R. H. Warder, Mr. Geo. S. Huntington, Prof. Geo. W. Harper, Prof. Jos. F. James, Dr. A. E. Heighway, Sr., Dr. A. E. Heighway, Jr., Mr. T. H. Aldrich, Dr. C. E. Caldwell, Mr. Wm. H. Fisher, Mr. E. O. Hurd, Mr. Chas. Dury, Mr. E. M. Cooper.

It would be of great benefit to the museum and aid in its work, if donations could be still more liberal.

The kind of donations specially needed, are well identified

specimens, with locality, in the departments of Botany, Conchology, and Palæontology. In these departments not only are new specimens needed but duplicates as well, for lack of which many desirable exchanges have had to be passed by. Though there is quite a quantity of duplicate material much of it is worthless for exchange purposes, wanting both name and locality. In answer to appeals for such material, liberal contributions have been received from Mr. C. L. Faber, Mr. A. Freed of Lancaster, Mr. Shepherd of Mason, and Capt. M. M. Murphy of Ripley, O.

This question of duplicate material has become quite a serious one in connection with the continuance and extension of the work of the Society abroad, and it is hoped that the officers and members will take the subject into serious consideration. Several changes have been made about the museum which have added to its appearance and increased the space for display of specimens. The room at the end of the hallway on the first floor, which had been used as a store-room, has been cleared of cases and all material stored there. The walls and ceiling have been cleaned and painted, the floor covered with linoleum, and the entire room improved in a style befitting a vestibule to the artistic apartments of the Photographic Section. In order to provide for the quantity of material thus deprived of storage room, about 200 ft. of shelving has been placed in the basement, which is sufficient for all present needs. The cases which previously have occupied space in the lecture room and hallway have been removed to the second and third floors.

The work indicated above has been done in accordance with the instructions of the Building Committee.

VISITORS.

It is gratifying to report that the museum is constantly becoming better known as a place of public interest; this is indicated by the increasing numbers of visitors. About 1500 have passed through the rooms during the past eight months, exclusive of the large number who have attended the lectures. These visitors represented 22 States of the Union, and one foreign country. The largest number of visitors of any one day, was on Sept. 27, when 115 were recorded. The Society will be greatly benefited by thus extending the circle of its aquaintances, and all proper means will be employed to attract visitors.

In connection with the question of extending the influence of the society, it should be remembered that next year the Centennial of our State will be celebrated in this city, and it may not be a great deal too early to begin thinking as to what it is possible and best for this society to do for herself on that occasion.

LECTURES.

Two very successful courses of lectures have been conducted in the lecture-room of the museum during the winter. The first of these was a course for the teachers of the public schools, given by Dr. C. E. Caldwell, on physiology and comparative anatomy. The course comprised ten lectures, and Dr. Caldwell rendered each of the subjects treated very interesting and profitable to his hearers. The number of membership tickets issued for this course was 55, distributed as follows:

Cincinnati	31	teachers distributed	District school,	25
			Normal	2
			Intermediate	2
Covington	11		Teachers	29
Newport	13		Principals	2

The attendance at first was quite full, and though falling off somewhat toward the latter part of the course, yet the attendance throughout was very satisfactory. The decrease in attendance can not be attributed to either a lack of interest or to the methods of conducting the course, but rather to the fact that Saturday is the only free day of the week for the teacher, and the ordinary duties of study on this day are very considerable, besides necessary rest and recreation, and further to the unfortunate fact that school boards are not satisfied with five days of good work from the teachers, but oblige them to give up a portion of the sixth to attend teachers' meeting; it is to these circumstances that we must attribute the small attendance on lectures intended especially for for teachers. Similar lecture courses have been conducted by other scientific societies, notably the New York Academy of Sciences, and Boston Society of Natural History.

The sixth course of Free Popular Scientific Lectures was in every respect successful, and the lecture committee consisting of Mr. Wm. H. Knight, Chairman, Mr. J. Ralston Skinner and Miss Anna Brown, deserve hearty commendation for their selection of lecturers and the general conduct of the course. Lectures were given as follows:

January 14th. "Climate, Plant Life and Consumption."
Dr. Walter A. Dun.

January 21. "Deep Sea Explorations."
Prof. Jos. F. James, of Miami University.

January 28. "The Moon."
Prof. Jermain G. Porter, of Cincinnati University.

February 4. "The Retreat of the Ice and the Evolution of Lake Erie," with maps and illustrations.
Prof. Edward W. Claypole, of Buchtel College.

February 11. "The United States Fish Commission."
Mr. Herbert Jenney.

February 18. "Forestry."
Mr. Reuben H. Warder.

February 25. "Sun Spots," with diagrams.
Prof. Amos R. Wells, of Antioch College.

March 4. "Gas as a Fuel," with illustrations.
Prof. N. W. Lord, Ohio State University.

March 11. "Earthquakes."
Prof. J. W. Hall, Jr., Principal Covington High School.

March 22. "The Origin of Man and other Mammalia."
Prof. E. D. Cope, Philadelphia Academy of Sciences.

March 25. "Bird Life."
Prof. F. W. Langdon, of Miami Medical College.

The lecture by Prof. Claypole, of Buchtel College, on the Retreat of the Ice and the Evolution of Lake Erie, was given in College Hall, as was also that by Prof. N. W. Lord, of Ohio State University, on "Gas as a Fuel." Both lectures were well attended and great interest was manifested in the subjects treated. The other lectures were given in the lecture-room of the museum, which was well filled on every occasion, and generally more attended than could be seated.

The lecture by Prof. Cope, of Philadelphia, on the "Origin of Man and other Mammalia," was a pay lecture, the proceeds to go to the society's building fund. This lecture was given in the hall of the Scottish Rite Cathedral.

The Lyceum of Natural History for the young people was organized Saturday, January 8th, by authority given by the executive board of the society to the custodian, in answer to a proposition for such an organization made by him to the board at their meeting in November, 1886. One hundred and seventeen boys

and girls from the intermediate and high school grades of Cincinnati, Covington and Newport have been enrolled to date, and of these the majority show themselves to be truly interested in their study of Natural History.

The meetings for the younger members are held each Saturday morning at 10 o'clock, and at these meetings some subject of Natural History is treated of in a short talk, and illustrated as far as possible with specimens. At present the subject is zoology, and specimens of star-fish, sea-urchins, sponges, crayfish, etc., have been briefly described and given to the members to study for themselves, and hand in a written report of their study. A similar method is pursued with the older members, meeting Saturday afternoon, and studying zoology and botany.

The expenses of the Lyceum are met by a monthly due of ten cents from each member. A good supply of material has been obtained from the Boston Society of Natural History. Dr. Walter A. Dun, Dr. B. M. Ricketts and Mr. Wm. Hubbell Fisher have kindly rendered valuable service by giving lectures to the members of the Lyceum. Other lectures will be given by Mr. Wm. H. Knight, Mr. Chas. Dury and others. These lectures are looked forward to with eager interest by the members, and we hope others of the society will co-operate in this work for the young people.

It is hoped that the Lyceum will become an established institution in the Society and more ample provision be made for it, in the future. One fact is established, that is, that there is a large number of young people in the three cities, representing the brighest and most studious element in the public schools who would gladly embrace an opportunity to do good practical work in Natural History if such were offered, and it is for this Society to say, whether it will offer this opportunity, and place itself foremost among the scientific societies of the West in this respect, and make Cincinnati a center of science as she now is of art and and music. In no other branch of learning is there the demand for special training that there is in Natural History yet you can count on your fingers the educational institutions in this country which offer special inducements in biological studies.

In the work of the museum for the coming year it is the intention to give special attention to the collecting of representatives of the flora and fauna of the State and this locality. A collection which will represent the lithological and palæontological

characteristics of the geolgical formations of the State is also planned. In the prosecution of this work it is desired to establish a system of exchanges, by which the Society will have special collectors in various parts of the State, who will not only collect for us of their local material but will also make efforts to secure for this society rare specimens which may come to their notice A few such collectors have already been secured and it is believed that such a system may be established which will be of great benefit to the Society. The cooperation of members in this connection is most earnestly solicited either by contributions as suggested in another part of this report or by reference to friends who are collectors who would be willing to collect for the Society.

The executive board has appropriated a sufficient amount of money to cover the expense of mounting the shells of the collection on card-board. This work will be carried on during the Summer and will add much to the attractiveness of this beautiful collection and aid in its preservation as well.

I wish to take this occasion to thank the members and officers of this Society for the uniform cordiality shown me during my term of office.

Respectfully submitted.

HORACE P. SMITH, *Custodian.*

REPORT OF THE CURATOR OF GEOLOGY.

(Abstract).

This department has been for years hampered in its work by want of case room. I have reported this fact, and made suggestions for the better display of the specimens on hand, as well as the necessity of filling in certain groups in our collection but no notice has been taken of my requests. These are a matter of record and if the society wishes to make the necessary changes and purchases, may be easily referred to. In addition to my former suggestion I would say that we should make an effort to have a complete suite of the fossils of our locality which should be arranged and placed by *itself*, and called the Cincinnati Group collection. Of course nothing can be done until suitable case room is provided for such a collection. The cases now in the Paleontological department are wholly useless for display or study. They should be wholly "*reformed.*"

In furtherance of this plan, I would suggest that members bring such specimens of our common fossils as they do not desire for their own exchanges or collections. All specimens, no matter how common, can be utilized in exchanges. Cincinnati and the vicinity is the finest hunting ground in the world, but the march of improvement is rapidly covering up the best localities, and in a few years the present opportunities will have passed away.

J. W. HALL, *Curator of Geology.*

REPORT OF THE CURATOR OF BOTANY.

To the President and Members of the Cincinnati Society of Natural History:

I beg leave to submit the annual report for the department of Botany.

The Pringle collection of Mexican plants has been catalogued and placed in tne herbarium. Also fifty-three specimens of mosses and twenty-four of algæ from the Pacific coast, received from Mrs. R. W. Summers of San Luis Obispo, Cal.

The card-catalogue of the 4350 specimens now in the Society's collection is almost completed. A few additions have been made to the collection of the Cincinnati flora. The Custodian is making a duplicate collection of the Ohio flora for purposes of exchange. Exchanges are in progress with Mrs. R. W. Summers, San Luis Obispo, Cal., Miss Alice Little, Dresden, O., A. Freed, Lancaster, O., Wm. R. Lazenby, Columbus, O., and Geo. J. Streator, Garrettsville, O.

Donations have been received from Dr. O. D. Norton, Davis L. James, Geo. B. Twitchell, Miss Mary Magurk, A. P. Morgan, Mrs. Mary Stubbs, G. H. Curtis, Geo. C. James, and H. P. Smith.

The principal feature of the year is the publication in the Journal of articles on the "Mycolgic Flora of the Miami Valley" by A. P. Morgan, which is represented in our collection by beautiful paintings executed by Mrs. A. P. Morgan, and presented by herself and husband.

The botanical section has held regular meetings, except during the summer months, at which a number of interesting papers have been read; a series of biographical ones, of which the subjects were eminent botanists, being particularly enjoyed. The

section failed to realize the hope that the collection of Cincinnati and Ohio flora would be greatly increased. The supply of this need should receive special attention this season.

Respectfully submitted,
NETTIE FILLMORE.

REPORT OF CURATOR OF ENTOMOLOGY.

(Abstract.)

The department of Entomology has received but few additions during the year—about 34 species. Insect "pests" have destroyed some specimens during the year. It is recommended that a series of insects be mounted to exhibit their economic value, or their injurious effect. GEORGE S. HUNTINGTON.

REPORT OF CURATOR OF ZOOLOGY.

(Abstract.)

The additions to the department have been: birds, 89; mammals, 8. The collection is free from "museum pests," and (except the white-plumaged birds, which show the effect of coal soot) are in good order. The cases in this department are inadequate to preserve the specimens from dirt, or to admit a proper display or arrangement of specimens. Provision has been made to secure mounted specimens of common birds lacking in the collection. Many families of our native birds are not even represented by a type specimen. It is desirable that such deficiencies should be filled. CHARLES DURY.

REPORT OF CURATOR OF OSTEOLOGY.

(Abstract.)

Only a few additions have been made to this department during the year. The skeleton of the giraffe, which stood in the hallway of the second story, has been placed on the fourth floor with the other specimens of osteology. It is very desirable to make our collection of domestic animals as complete as possible, and whenever specimens can be obtained it would be well to secure them. O. D. NORTON.

REPORT OF THE CURATOR OF ANTHROPOLOGY.

Valuable additions have been made to the collections during the year. The society's collection in this department is already

quite valuable, but cannot be displayed to advantage for want of room. There are a number of specimens in the collection not to be found in any other, and are therefore too valuable to be exposed in a building that is not absolutely fire-proof.

GEORGE W. HARPER.

REPORT OF THE CURATOR OF MICROSCOPY.

Since April, 1886, two exhibitions of microscopical objects and apparatus have been given by the society. One on the 30th of May, a general exhibition, and an exhibition of histological preparations on the 2nd of October. Several meetings were held for the purpose of forming a section of microscopy, but without effecting an organization. This is especially unfortunate, as one of the prime objects of this society is the study of the Natural History of our immediate vicinity. Our students of the higher animals and plants have, in cataloguing at least, left comparatively little to be done, but next to nothing is known of the microscopic fauna and flora of our neighborhood.

During the past year the following preparations have been added to the collection of the department: Two slides of diatoms, a section of peccary hair and a preparation of so-called volcanic ashes. Respectfully submitted,

GEORGE B. TWITCHELL.

REPORT OF THE CURATOR OF CONCHOLOGY.

During the past year four hundred species and varieties, known as the Hemphill Collection, have been catalogued and placed in cases. This collection was purchased and received previous to the last annual meeting of this society, but owing to a lack of case room was not unpacked. Even now it is not in proper condition, but in cases belonging to another department. A number of fine exchanges have been made; one with Mr. T. H. Aldrich of thirty-two species, another consisting of forty species with Mr. H. E. Dore, of Portland, Oregon, and still another with Mr. Arturo Bofill, of Barcelona, Spain, numbering one hundred and forty species. Mr. Aldrich also presented a number of species, and a large donation of two hundred and twenty-one species was received from Mr. Charles Faber.

The total additions to the cabinet during the year have been about nine hundred species, and the custodian has carefully done his part of the work, thus making a fine showing in the department of conchology.

MRS. H. B. MOREHEAD,
Curator of Conchology.

REPORT OF THE LIBRARIAN.

(Abstract.)

The exchange list of the Society has been increased during the year by the addition of the publications of ten societies, including the publications of the Geological Survey of India, the Royal University of Norway, the German Scientific Society of Santiago Chili, the Entomological Society of Washington, etc., etc.

There have been added to the library during the year, by donation and exchange, about 400 books and pamphlets. The most valuable being the volumes of the Geological Survey of India. These volumes have been bound in plain substantial binding and the forty volumes contain a vast amount of valuable material.

Next to this set is the publications of the Pennsylvania Geological Survey, nearly all of which are now in the Society's library.

Donations have been numerous. The largest was from the Estate of Dr. E. S. Wayne received through Dr. O. D. Norton. This consisted of about 100 books and pamphlets, many of them of great value.

A new book case has been ordered and will soon be ready to be placed in the library.

GEO. W. HARPER, *Librarian.*

ORNITHOLOGICAL NOTES.

By Chas. Dury.

Least Bittern.

Botaurus exilis (Gmel.)

Several specimens of this species were taken at Ross Lake during April and May, 1887.

Orange Crowned Warbler.

Helminthopila celata (Say.)

On April 29th, I shot a fine male of this species near Avondale. The bird was feeding on small beetles and other insects (with which its stomach was filled). This is I believe the first recorded instance of the identification of the species in the immediate vicinity of Cincinnati.

Short-eared Owl.

Asio accipitrinus. (Pall.)

In many years I have never known this owl to be so numerous in Southern Ohio. The first specimens were observed in Nov., 1886, and they remained in suitable localities until April, 1887. They lived in low flat meadows that were covered with long dry grasses and weeds. Near Glendale during February a young man saw a large white owl which from his description seemed to be *Nyctea nyctea* (Linn.) flying across a swampy field. He went home for a gun and returned to secure the bird, but he failed to get it. While crossing the field which was inundated with water, numbers of Short-eared owls flew up until over thirty were counted in the air at one time, there was only one tree in the place and on it all of the owls perched presenting a very curious and unusual sight. All of the low parts of the field where the owls were congregated was flooded by rains driving the mice to patches of higher ground and giving the owls a chance to capture and devour them.

One owl shot in this field contained three full grown meadow mice. Of over twenty of these owls examined since Nov., 1886, up to May 1st (and excepting in one instance, Nov. 26, when I took an imported sparrow from one), their food seemed to be exclusively mice.

Relating to the food of Raptorial Birds and supplementing a paper read by me before this Society, April, 1885, I present the following items.

LONG-EARED OWL.

Asio wilsonianus. (Less.)

Male, from Warren Co., Ohio, Nov. 10. Contained insects.

Male, from Hamilton Co., Ohio, January 10. Contained mice.

GREAT HORNED OWL.

Bubo virginianus (Gmel.)

Male, Cincinnati, Nov. 24. Contained Beetles (Geotrypes.)

Female, Canton, Ohio, January. Filled with mice.

RED-SHOULDERED HAWK.

Buteo lineatus (Gmel.)

Hamilton Co., Ohio, Nov. 29. Contained one frog.

COOPER'S HAWK.

Accipiter cooperi (Bon.)

Female, Glendale, Dec. 22. Contained one European Sparrow.

SCREECH OWL.

Megascops asio (Linn.)

January 12, Cincinnati, Ohio. Contained the remains of four mice.

DEATH OF THE ZOO OSTRICH.

The fine large female Ostrich belonging to the Zoological Garden was found dead one morning, although the keeper had left her the evening before seemingly in perfect condition of health. An external examination revealed the fact that the right tibia and fibula had been fractured near their lower ends. On opening the body an egg mass was found. It had in the centre a normal sized ostrich egg, enveloped in a succession of leathery shells in layers one outside of the other. There were about twenty of these layers and the entire mass measured 18x13 inches. The largest normal Ostrich egg measures about 5x6¼ inches. The bird fractured her leg in a desperate effort to be delivered of this enormous egg.

AVONDALE, JUNE, 1887.

BIRDS.

*A lecture delivered before the Cincinnati Society of Natural History, March 25th, 1887,**

By Dr. F. W. Langdon.

Mr. President and Ladies and Gentlemen :

Birds are objects of much interest and importance to all mankind, savage and civilized, of all ages, both sexes, and every social condition.

The *savage* prizes their products for food, clothing and personal adornment; tips his weapons with their feathers and constructs many articles of household utility from their bones and skins.

In the history of the early American civilizations we are told that one of the most gorgeous robes of state of the great Montezuma, was composed almost entirely of the plumage of brilliant birds; and many a South-American princess to-day wears a dress of feathers, which for scantiness and unique effect might well excite the envy of some of her fashionable civilized sisters. While civilized man *in general* is attracted by their beauty of plumage, melody of voice and wonderful structure and architecture, to certain *classes* of civilized men, Birds possess an especial importance economic or æsthetic, as the case may be; and each of these classes is apt to have its own peculiar views as to the

Relation of Birds to Mankind.

As a distinguished American philosopher has said, "everything depends on the standpoint of the individual"—

The *epicure* for instance, sees in their structure, form and flavor, an especial adaptation to artistic cookery and gastromomic attainments; and few of us perhaps, are entirely oblivious to the charms of "quail on toast."

The *sportsman*, considers them chiefly useful in connection with the training of dogs, and the cultivation of marksmanship, with the mental and physical excitement attendant thereon.

The *taxidermist*, might infer, from the very convenient distribution of their feathers and the positions of their joints, that birds were constructed especially to be skinned, stuffed and mounted for

*Published by special request of the Publishing Committe.

ornamental or museum purposes, while the *bird fancier*, on the other hand sees in them so many objects to be "improved," as *he* terms the over-development of certain parts, by means of crossing, selection of freaks, etc.

The *milliner*, with an eye to business, studies their various forms and tints with a view to harmonizing them with the complexion and costume of the fashionable customer; while the *agriculturalist* complains that certain species destroy his products, and rejoices that others are of value by reason of preying on noxious insects and plants. So important in fact, has the relation of birds to agriculture been shown to be, that it has been made the subject of special inquiry by the U. S. Government, through a newly established "Division of Ornithology" of the Department of Agriculture, at the head of which is the well-known ornithologist, Dr. C. H. Merriam.

The methods and objects of this "Division of Ornithology" are explained in a circular which I shall be glad to supply to those interested.

On a plane far above the merely economic relations of birds, stands their availability to the *poet* and *artist*, as subjects for pen and brush; and the true *naturalist*, to fully appreciate their many beauties should be something of both and more than either:— for, to him, *all* matters connected with them possess an interest; their structure, colors, voice, habits, food, architecture, topographical and geographical distribution, migrations, etc.;—and if he combines with the poetic and artistic sense the power of accurate and systematic observation of living birds; and with these again, the appreciation of their wonderful structure and relations to each other and to other animals,—*then* indeed is he a *naturalist* in the broadest sense of the word, and his observations and conclusions systematically recorded are a monument to his talent and industry, which no time can destroy. Such were Wilson and Audubon, the pioneers of American Ornithology, and many might be mentioned amongst living naturalists who are their worthy successors.

While volumes have been and will be written upon the beauties of birds — their brilliant plumage, the melody of their voices, their unique architecture and so on, this is not by any means *all of Ornithology*; in fact as a distinguished ornithologist has said, all these "however pleasing they are to the senses, do not satisfy the mind, which always strives to make orderly disposition of things,

and so discern their mutual relations and dependencies."* Hence, in order to satisfy this mental craving for a knowledge of the relations of birds to other animals, including man, we must have a *Classification*, without which there is no science.

Passing, then, from the consideration of the economic and æsthetic uses of birds, let us take a glance at their *Zoological relations*; in other words—at the

ELEMENTS OF SYSTEMATIC ORNITHOLOGY,

which, once mastered will leave you free to pursue the remaining features of the study if you so desire.

Let it be distinctly understood at the start, that the basis of all zoological classification at the present day is *structure*,—that is to say, *anatomy*.

In order to classify birds, we must define them; that is recognize their differences in structure from other animals. This, in the case of recent birds, is not at all difficult to do; briefly stated, *a bird is a feathered vertebrated animal.* While this definition is sufficient, as already indicated, to seperate all *recent* birds from reptiles, batrachians and fishes, on the one hand, and from mammals on the other, yet there are good grounds for the belief that, were one to possess a complete series of extinct birds, we should have difficulty in distinguishing them by their outer covering alone. In other words, we should perhaps find animals in which scales and feathers would so intergrade that it would be impossible to say where scales ended and feathers began.

Hence our definition might be insufficient to define birds from reptiles. It may be stated, in fact, as a general rule, that all Zoological and Botanical definitions are faulty in so far as they mark distinct lines which do not exist in nature, but which are arbitrarily adopted by man for his own convenience.

A good descriptive definition of birds is thus presented by one of our ablest American ornithologists:—†

"A bird is an air-breathing, egg laying, warm blooded, feathered vertebrate, with two limbs (legs) for walking or swimming, two limbs (wings) for flying or swimming, fixed lungs in a cavity communicating with other air cavities, and one outlet of urinary and generative organs; with (*negative characters*) no teats, no teeth, no fleshy lips, no external fleshy ears, no (perfect) epiglottis nor diaphragm; no bladder, no scrotum, no corpus collosum. Other

*Coues "Key to North American Birds."
† Ibid.

collateral characters are given, but these sufficiently distinguish birds from reptiles on the one hand and mammals on the other. Perhaps the majority of modern zoologists accept Huxley's arrangement of birds and reptiles as off-shoots from one group—the *Sauropsida.*

As already stated, *structure* is the only basis of modern classifications.

Formerly classifications were based on habits, food, distribubution, etc; but these have all been found to be unreliable and subject to change regardless of structure.

Various similes have been used to illustrate ideas of relationship in structure of the different forms of life.

One of the oldest of these is to liken species of animals to the *links of a chain* and arrange them in a linear series, with gaps representing extinct or undiscovered species. This would be equivalent to the attempt to place all mankind in a contінous row, in the order of their relationship to each other; and you may readily see, that, if we attempted this we should very soon find *two* persons who were of equal relationship to a third and hence our linear series would become bi-linear, then tri-linear and so on, so that the resemblance to a chain would disappear.

A second simile, is that of a tree, with few main divisions, more large branches and numerous twigs; this is, I think best suited to the illustration of all Biological problems. If we compare *life* then, with the trunk of our tree, (Fig. 1) we have two great divisions of organisms, which act as vehicles or agents for its expression—viz: Vegetable and Animal,—these divisions called in systematic Biology "Kingdoms."

Leaving the study of the vegetable part of our tree to the botanist, and tracing out the *Animal Kingdom*, we find that all animals might be conveniently placed in five great groups, occupying five great branches of our tree, so to speak. These groups, called *Sub-Kingdoms* are: (see diagram, Fig. 1.)

1. The Protozoa (first animals) or simplest animals, (Infusoria etc.)
2. The Radiata or radiated animals, (Star-fishes, sea-urchins.)
3. The Articulata or jointed animals, (Insects, lobsters, etc.)
4. The Mollusca or soft-bodied animals, (Snails, oysters, mussels, etc.)
5. The Vertebrata or back-boned animals.

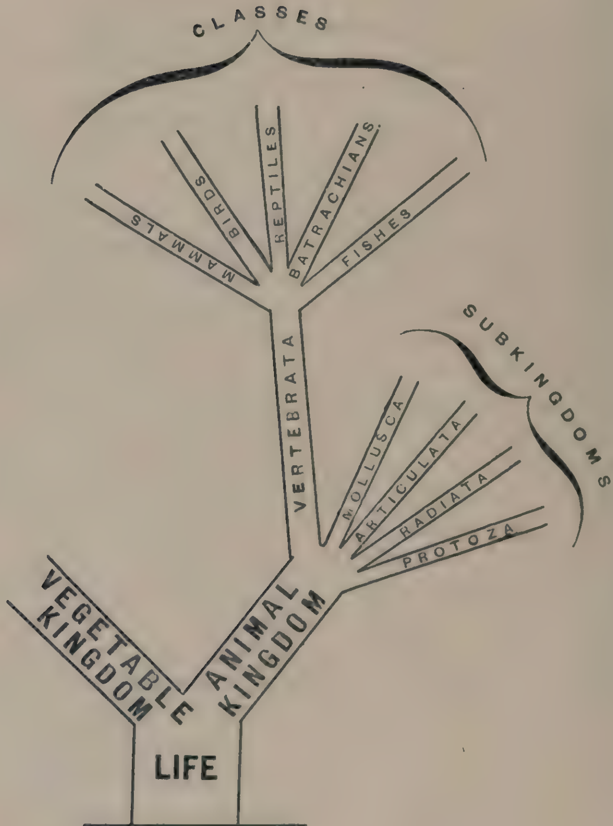


FIG. 1.

Diagram to represent a purely arbitrary classification of animals.

Following up only the Vertebrata branch of our tree, we find the vertebrates conveniently divided into five sub-groups called classes, viz:

Fishes, Batrachians, Reptiles, Birds and Mammals.

Now while it simplifies the problem to consider each of these sets of groups as bearing the same relation or value to each other, as off-shoots from a common trunk, such, in nature, is not the case, in other words it is difficult to find two groups precisely alike in relative importance, just as it is seldom we find two branches or twigs exactly alike on the real tree.

The problem then is somewhat more complex than we see it here—and, the method of growth of our tree may be more properly represented somewhat after this fashion (see Fig. 2.)

To the scientist, birds possess a peculiar interest on account of their apparant isolation from all other classes of Vertebrates; in other words there is an absence, amongst *recent* birds at least, of "connecting links," between them and their presumed progenitors, the reptiles—this being indicated on the diagram by the broken lines.

Amongst recent birds the Penguins and Ostriches approach nearest the reptiles in structure; but fossil forms are known so intergrading between birds and reptiles, that modern Zoologists have placed *all* Reptiles and Birds in one "class" called *Sauropsida*.

In addition to the larger groups into which animals are classified, as shown in our diagram, they are further subdivided (or classified) into numerous smaller ones. Taking the branch (class) "Birds" for instance and tracing it out to its ultimate twigs, we would find it divide into or give off several smaller branches called "Orders," of which there are seventeen represented amongst North American Birds; these seventeen "orders" again give off still smaller divisions called "families" (66 in North America:) the "family" branches give off in their turn "genera" (321 in North America) and each genus sprouts a variable number of "species" (768 in North America, or about 10,000 in the world,) which would represent the terminal twigs of our tree, or that portion of it devoted to the genealogy of *birds*.

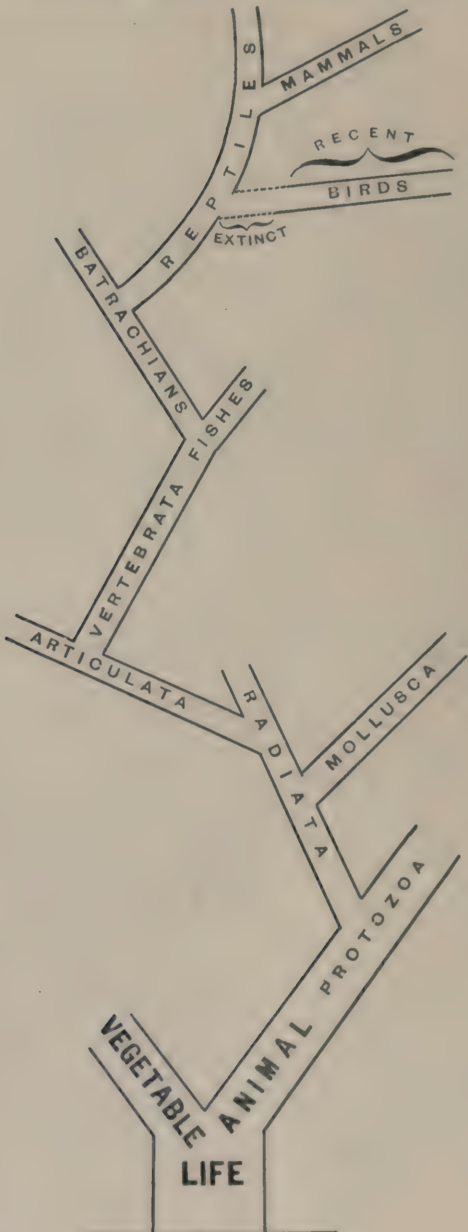


FIG. 2.

A classification of animals to indicate their structural relationship and chronological sequence.

Putting this statement in diagrammatic form, with respect to North American Birds only, would give us the following in ascending series from the largest group to the smallest,—premising that each group includes all those beyond it, and sprouting from it. See Fig. 3.

We have then as the chief groups into which living things are classified

Kingdoms—based on *materials* of structure.

Sub-kingdoms,	based on	*plan* of structure.
Classes,	" "	larger details of deep structure.
Orders,	" "	smaller details of deep structure.
Families,	" "	smallest details of deep structure.
Genera,	" "	larger details of external structure.
Species,	" "	smaller details of external structure.

To these there are added,

Varieties—based on the smallest details of external structure.

Where varieties are apparently constant in their differences from the main species and such constancy can be attributed to peculiar conditions of environment, the term "variety" gives way, in modern advanced terminology to "sub-species" or "incipient" species, the inference being that a new species is in process of development.

While all these groups then are arbitrary in one sense, they are the result of a general agreement of biologists as to what constitutes importance in variation and relationship in structure.

The *aim* of Zoological classification as already stated, is to indicate relationship.

Now, the question may be asked by some "of what *use* is this (apparently) complicated system of classification?"

We may reply:

First: it satisfies the mind in its desire to study the relationship of all living things.

Secondly: it conduces to economy of time and labor in (*a*) the recording of facts, (*b*) the identification of specimens, and (*c*), the reference to literature.

In order to illustrate one of these uses of classification: suppose a person with no knoweledge whatever of birds was to come into possession of a common North American Robin, and desired to read something of its history and habits. First, of course, he must know its name, in order to find it in the books.

Now supposing the most accurate description of all our North

FIG. 3. Diagram to represent the groups of recent North American Birds.

American birds to be contained in a book and arranged without regard to classification, or again suppose our amateur collector pays no attention to classification if present; he will either search at random amongst seven hundred and sixty-eight descriptions, or read over perhaps the greater number of them before finding his bird.

What, on the contrary, is the method of one who knows the uses of classification.

Being a North American bird, it must belong to one of the seventeen "orders," having traced it (by reading the seventeen descriptions or less) to the Order *Passeres* or Perchers, he finds that there are twenty "families" to which it may belong; their descriptions having told him it is a member of the family "Turdidæ" or Thrushes, he must now trace it to its proper "genus" through seven descriptions. The genus *Merula* describing it correctly, there remain three descriptions only to read, that being the number of North American species in the genus.

To recapitulate, we have traced our specimen through

17 Orders to Passeres,
20 Families of Passeres to Turdidæ,
 7 Genera of Turdidæ to Merula,
 3 Species of Merula to migratoria.
—
47 descriptions in all, as contrasted with 768 had we no classification to depend upon. The name of our bird, then is a compound of its generic and specific names, viz:

Merula migratoria.

Now, supposing our collector to have sufficient knowledge of structure aud classification to refer his bird at once to its proper "family" or "genus," his labor of identification is still more diminished.

Some of the more important structural and physiological peculiarities of Birds, Mammals and Reptiles are contrasted in the following table.

	Mammals.	Birds.	Reptiles.
Skull,	with 2 condyles, (neck-hinges.)	one condyle.	one condyle.
Collar bones,	separate or absent.	joined together by bone (forming the "wish-bone.")	separate or absent.
Brain,	complex, surface usually convoluted.	less complex, surface smooth.	least complex, surface smooth.
Heart,	with 4 chambers.	4 chambers.	3 chambers.
	Temperature 98°—100° F.	108°—112°.	about 40°.
Blood,	Red cells circular disk-shaped (except in camels, where elliptical); not nucleated.	red cells elliptical and nucleated.	red cells elliptical and nucleated.
Lungs,	structure complex, capacity large, no communications with other air spaces except through trachea.	less complex, capacity large, free communications between air cells and various air sacs throughout the body and in the bones. (A bird may breath through a broken bone after the windpipe has been stopped.)	least complex capacity small, extra air sacs and spaces absent.
Rate of respiration,	slow (8 to 30 per minute).	rapid (24 to 60).	variable, but very slow, and may be suspended for long periods.
External covering,	hair.	feathers.	scales.

Now, a word to those persons who may contemplate entering upon the study of birds and the formation of a systematic collection;—and let me say that my remarks this evening, are largely in answer to numerous inquiries received from just such persons.

In the beginning the student should have a definite idea as to the extent of country his collection is to represent—whether a locality, a state or a continent.

He may begin his collecting and identification of specimens personally, if he so desires, and this will give him a more accurate and thorough knowledge in the end perhaps. Should he desire to expedite matters, however, he may purchase from a dealer a few representative skins, and using these as a working basis, develop his knowledge of structure more rapidly. Let him bear in mind however that it is not *rarity* he desires in these working specimens, but rather the common types of the section of country he desires to work up. Having obtained an elementry knowledge of structure and classification, he will be prepared to take up the more advanced problems connected with bird-life.

To the question then, what constitutes the science of ornithology, I would answer:—The knowledge, systematically arranged, of *facts* pertaining to birds.

1. Of their *structure.*
2. Of their *structural relations* to other animals.
3. Of their *physiology* or *life histories*—as food, habits, voice, nests and eggs, etc.
4. Of their *distribution*, topographical, geographical and chronological.
5. Of their *economic relations* to man and other animals.

The means of acquiring this knowledge are:

1. A good shot-gun and suitable ammunition.
2. A note-book for field use.
3. Instruments for dissecting and skinning birds.
4. Some dry powdered arsenic for preserving skins.
5. A catalogue or permanent record book.
6. A cabinet or boxes for specimens.
7. One of the standard text books on Ornithology, as Coues' "Key to North American Birds" or Ridgway's "Manual of North American Birds."

And finally, an accurate eye, a clear head and unlimited industry and perseverance.

In conclusion Ladies and Gentlemen, let me remind you that "line upon line, precept upon precept," species upon species, is still the most practical method of acquiring a knowledge of Ornithology, as of any other subject,—"there is no royal road to (bird) knowledge."

THE JOURNAL

OF THE

Cincinnati Society of Natural History.

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PROCEEDINGS.

BUSINESS MEETING, *July 5th*, 1887.

President Skinner in chair, 21 members present.

Minutes of April meeting read and approved.

The following persons were elected to membership, Dr. E. G. Betty, Chas. P. Fennel, Miss Louise Horsely, Dr. James G. Hyndman, Omar T. Joslyn, John Moneith, Warren K. Morehead, Dr T. A. Reamy, Miss Louise Stewart, Miss Belle Woods. On motion the reading of the minutes of the Executive Board was omitted.

Dr. O. D. Norton was elected to fill the vacancy in the Executive Board, by reason of the resignation of Mr. Geo. Bullock.

The committee appointed at the previous meeting to audit the report of the treasurer reported the accounts correct.

Mr. Fisher's resolution to amend the By-Laws by inserting the word "Corresponding" in Section 1 of Article 6 was amended by Mr. Knight by adding the word "Honorary". The amendment was accepted by Mr. Fisher and the amendment laid over for another month.

Prof. Jos. F. James read, by title, an elaborate paper on "The Monticuliporoid Corals of the Cincinnati Group with a critical review of the species." The speaker took occasion to remark that the paper was contributed by his father Mr. U. P. James and himself. He stated that Mr. James has the largest collection of these fossils in existence and has made a careful study of their internal and external characteristics. He remarked further, that they had attempted a classification of the species upon the external charac-

ters, the only classification which can be of practical value to the student.

Mr. Riggs, by invitation, spoke of his explorations among the Indian mounds of Missouri and Arkansas. He stated that they seemed more numerous than in the Ohio Valley and that the pottery found in them showed more artistic decorations.

Dr. A. E. Heighway, Jr. had noticed hundreds of mounds in South Carolina, ranged in crescent shape along the hill sides. Arrow heads were abundant, but he saw no pottery.

Mr. Skinner called the attention to the cast of a piece of sculpture, found in a Florida mound. It was of a human head and had been described by Dr. Forbes in the Toledo Blade as a "Cleopatra" from its close resemblance to the Egyptian type.

Dr. Langdon replying to Mr. Riggs' question, whether pottery was generally found with mound skeletons, said that such is the case, the pottery being placed by the head or shoulder.

Donations were announced as follows:

From Prof. S. A. Forbes, Pamphlet, ' The Lake as a Microcosm"; from F. W. Putnam, Pamphlet "Conventionalism in Ancient American Art"; from Publishers Scientific American, Scientific American Supplement.

August 2d, 1887.

Regular Scientific meeting; seven members present.

No quorum—no meeting.

The members present spent the evening pleasantly, in looking over a copy of the folio edition of Audobon's Birds of America, loaned the Society by Mr. J. R. Skinner.

The donation book showed the following additions to the Society's property, as follows:

Donations: From J. B. Lovell, specimens of Cannel Coal; from J. E. Buchanan, Sterling, Col., opalized wood; from Prof. J. M. F. Snodgrass, iron ore; from Dr. O. D. Norton, stone implements; from Prof. J. M. Nickles, Fossils of Cincinnati Group; from Dr. S. S. Scoville, fossils of Cincinnati Group, Stone Axe; from Dr. C. L. Armstrong, fac-simile of Sir Walter Scott's Monument.

September 6 1887.

Regular Scientific meeting.

Seventeen members present; 2nd Vice President James in the chair.

The minutes of the June meeting were read and approved.

Mr. Horace P. Smith read a paper on the King Crab (Limulus polyphemus) and its relations.

The reading of the paper called forth remarks from members present. Dr. Young spoke of the morphology. Mr. Dury in reply to a question regarding the powers of vision in the "King Crab" said that it probably merely distinguished dim outlines of objects.

Dr. W. A. Dun exhibited a series of drillings taken from a well recently bored near Montgomery in this County, 12 miles north of the city and 810 ft. above the sea level. Gas was struck at 385 ft., nearly at the level of the bed of the Ohio. The Doctor said that the gas well at Felicity, in Clermont County, flowed at a pressure of 40 lbs. The strata furnishing this supply was about 600 ft. from the mouth of the well. Three wells have been bored at Middletown, O., without satisfactory results. The Doctor was still of the opinion that gas will be found in paying quantities east of the city.

A fine specimen of a portion of the skull of Bootherium cavifrons, Leidy, was exhibited by Dr. Dun. It was found in the drift on Walnut Hills. Dr. Young, by request, described the anatomical characters of the skull in Bison and Bos. The specimen under discussion had been referred to both genera. It was too imperfect to determine its proper place.

Mr. Geo Twitchell exhibited specimens of fresh water sponges from the Ohio river. He said:

"At the present stage of water in the Ohio river, sponges can readily be found adhering to snags or stones. Of the two species we have here to-night the encrusting form is immature and cannot at present be identified. While the form that might almost be called branching, is recognized as *Carterius tubisperma* Mills. The genus Carterius is a comparatively new one, the first specimen having been found in 1879. This genus differs from the other fresh water sponges in possessing appendages attached in various forms to the statoblasts. The specimens we have here have the statoblasts with their appendages well developed. An examination with the microscope will reveal beautiful spicules, both of the acerate and birotulate forms."

The presiding officer read a letter to himself from Prof. A. P. Morgan, as follows:

PRESTON, HAMILTON CO., O., July 18, 1887.

Mr. Davis L. James.

DEAR SIR:—The July number of the Journal is to hand. I am always interested in looking the Journal over critically, and seldom find anything to object to seriously. In the present number, however, I take decided exception to the report of the Curator of Microscopy. He states without qualification that "next to nothing is known of the microscopic fauna and flora of our neighborhood." He does not in the least qualify, "by me," "by most people," "so far as I am aware," or anything of the sort. And I suppose this statement passed muster of the meeting of the Society and the publishing committee, on the principle that "what is everybody's business is nobody's business."

1. In reference to the microscopic fauna: I am not so well posted in reference to what has been done as some of the older members are, but I have understood that a former president of the society gained a world-wide fame for himself as an entomologist by work upon a certain class of microscopic insects. I have understood that there is an elegant collection of spiders in the city. Very much microscopic work in a special and in a miscellaneous way has been done by Dr. Hunt and by others, more than I am able to name, I am sure.

2. In reference to the microscopic flora, the statement of the Curator of Microscopy is not true at all. More than 40 years ago Mr. Thomas G. Lea made a Catalogue of the plants of Cincinnati, which has ever since been authority among botanists the world over. This Catalogue embraces a list of more than 400 species of Cryptogams, comprising Mosses, Hepaticæ, Lichens, Fungi—*the characters* of which are microscopic to a greater or less extent—that is, these plants require the use of a compound microscope for their determination.

I have seen it stated in the Botanical Gazette, that Governor J. D. Cox is a very high authority upon Desmids and Diatoms.

Of the microscopic order of plants there remain only then not to some extent worked up, the *Freshwater Algæ* exclusive of Desmids and Diatoms to which I have understood all along the gentleman himself was devoting his attention. If he knows "next to nothing" of them it is his own fault. I myself would not like to state, however, that no other person knows "next to nothing" concerning them. Before making such a statement I should want

to feel sure that some other fellow in the neighborhood whom I had never seen, and concerning whom I knew little, was not tolerably well versed in these things.

With reference to my own work upon the Fungi of this region, I submit the following tabular statement compiled from my manuscript catalogue:

Hymenomycetes	536	species.
Gasteromycetes	45	"
Myxomycetes	58	"
Æcidiomycetes	51	"
Hyphomycetes	112	"
Physomycetes	8	"
Discomycetes	48	"
Pyrenomycetes	195	"
Total,	1053	"

Of these classes, all, except the first two, that is 472 species, are strictly *microscopic plants*—that is their characters are wholly microscopic, requiring the use of the compound microscope and magnifying powers of from 100 to 1000 diameters and a varied manipulation for their determination. The Hymenomycetes require the form and measurement of the spores which is commonly done with a magnifying power of about 400 diameters.

The Gasteromycetes require the form and measurement of the spores and the examination of the threads of the capillitium.

I would like to have the statements I make in these pages presented to the society in some shape or other. You are at liberty to read the whole, or such a portion as you see proper, at the meeting of the society. I am of the opinion that if sufficient pains is taken to bring out the fact the Cincinnati Society of Natural History can make as good a showing of active and effective work and progress in every department of Natural History as any other society in the country, East or West.

Very truly yours,

A. P. Morgan.

P. S.—For the sake of comparison, I present a tabular statement of the fungi of Lea's Catalogue, similar in form to the one I have given of my own work.

Hymenomycetes	206	species.
Gasteromycetes	8	"
Myxomycetes	15	"
Æcidiomycetes	14	"
Hyphomycetes	11	"
Physomycetes	3	"
Discomycetes	15	"
Pyrenomycetes	44	"
	316	"

A. P. M.

Mr. Twitchell said in reply to the position taken by Mr. Morgan:

"It is useless after this to assert that the statement made in my report was absolutely correct. Beyond a doubt it was too unqualified. Still Mr. Morgan in his desire to correct the error, has gone almost as far beyond the truth as I fell short of it. In the first place, unpublished work (however excellent) can hardly claim recognition in a review of the knowledge of a subject. The Fungi of this region have been worked up thoroughly but, although work has been done on the Algæ, I can find no list of our species of Desmids, Diatoms, or the Algæ exclusive of these groups. Now to take up the microscopic fauna: In 1882 was published in the Journal of this Society a synopsis of the Cincinnati fauna. This seems to be the latest literature on the subject.

The class Insecta has several orders marked—"not worked up." How much of this is microscopic I am not prepared to state. In the Arachnida *one* microscopic species is mentioned. (The list of Arachnida was prepared by the owner of the collection to which Mr. Morgan alludes.) This list also includes nine Crustaceans, eleven Annelids (nine of which are Rotifers), no Polyzoans, two Hydras, one Sponge, ten Infusorians and four Rhizopods.

Let us hope for the benefit of all future students of pond life, that this is next to nothing."

An amendment of the By-laws proposed by Mr. Fisher at the June meeting and amended by Mr. Knight at the July meeting, was presented to the Society for its consideration.

The proposed amendment was as follows: to insert in the last clause of Sec. 1 of Article 6, by-laws, the words, "Honorary and Corresponding" making the amended clause read as follows: "Ac-

tive, corresponding, honorary and life members, and invited guests only shall be privileged to read papers before the Society."

The question on the amendment being duly put, was carried and the amendment declared adopted.

The presiding officer read a note from Mr. W. H. Knight, resigning the office of Secretary, to take effect as soon as the Society can fill the vacancy by an election.

Upon motion the resignation of Mr. Knight was received and accepted. The election of a successor was laid over for one month, as directed by the constitution.

Donations were then announced as follows: From E. P. Cranch, Chalinula Sponge; from Humphrey Devereux, Mole Cricket; from Dr. W. A. Dun, Pamphlet, Water Birds of Japan; from R. M. Wall, Fungus; from Dr. O. D. Norton, Stone Axe; from Chas. E. Beecher, Monograph; "A Spiral Bivalve from the Waverly Group of Pennsylvania"; from Karl Lagenbeck, Report on the U. S. Coast Survey for 1853—54, Report on Exploration for a R. R. Route from the Mississippi River to the Pacific, Vols. II, IV to IX; from Edw. C. Toune, Monograph "Electricity and Life;" from Oliver Marcey, Report of the Dept. of Natural History at N. W. University; from Thos. L. Casey, Monograph, "On some new North American Psilaphidæ"; from Geo. B. Twitchell, fresh water sponges.

Adjourned.

ON THE MONTICULIPOROID CORALS OF THE CINCINNATI GROUP, WITH A CRITICAL REVISION OF THE SPECIES.

By U. P. James and Joseph F. James, M. Sc., *Prof. of Geology and Botany in Miami University, Oxford, O.*

(Read by Title, July 5, 1887.)

The group of fossils known under the general name of the Monticuliporoids, presents a wonderfully diversified series of forms. Not many years ago they were considered too obscure and too difficult for the ordinary student, and collectors, as a rule, paid little attention to them. One of us was among the first to call attention to them; and in 1871 issued a catalogue of the "Fossils of the Cincinnati Group", the first of its kind, in which were named provisionally, a few new species. A second edition of the "Catalogue" was published in 1875, and here two of the previously named species, and two new ones were described. In the same year the second volume of the Ohio Palæontology was issued, and in this Prof. H. Alleyne Nicholson described and figured a number of species under the generic name of *Chætetes*, adopting some of the names proposed in the catalogue of 1871. Between 1875 and 1881 were issued various papers or volumes containing descriptions of other new species, and in the latter year was published a monograph on the genus *Monticulipora* by Prof. Nicholson. In this volume, by far the most valuable account of this group of fossils which has yet appeared, we have chapters giving a general history of *Monticulipora* and its allies, an account of the general structure of the genus and its development, a division of the genus into five sub-genera with the characters of each, and detailed descriptions with figures, of forty-three species, thirty-three of which are found in the immediate vicinity of Cincinnati. Finally, Mr. E. O. Ulrich began, in 1882, in the fifth volume of the Journal of the Cincinnati Society of Natural History a series of articles entitled "American Palæozoic Bryozoa," which was continued through the sixth and into the seventh volume, 1884. Mr. Ulrich considered the *Monticuliporoids* as Bryozoa instead of Corals, and in the course of his investigations divided and sub-divided the old genus *Monticulipora* into a multitude, no less than eighteen, different genera. At the same time a host of species was described, most of them

from internal characters, and they were illustrated by a profusion of drawings of the internal microscopic structure. Our opinion of this vast array of genera and species and of microscopic work of this sort in general, will be given in detail later on in the present paper, but we cannot forbear saying that it is our belief that this work has resulted disastrously to the study of a confessedly difficult class of fossils; making it more difficult and confusing than ever before, and loading it with a mass of synonyms which of themselves are enough to deter one who should so desire, entering upon the study. The cause of this we believe to be an erroneous method of study, and we ascribe the vast number of species and genera made, to the almost exclusive attention given to microscopic characters.

The study which has been put upon the *Monticuliporoids* since 1871 has resulted in the identification and description of between sixty and seventy-five well characterized species from the rocks of the Cincinnati Group alone. When we consider their abundance in the various strata we need not be surprised at this result. The fossils are so common in many places in the vicinity of Cincinnati as to make up whole layers of rock. In certain places where they have been weathered out of the shale or rock, they can be gathered up almost literally by the bushel. While certain forms seem to be well defined and easily separable, others present such protean features as to become puzzling in the extreme. The extent of this group of fossils, the number of individual specimens, and the various forms some of them present, make it a good family in which to study the differentiation of species, and at the same time present one which should teach the palæontologist to be cautious how he makes new species on insufficient grounds, often mistaking individual for specific variation, and specific for generic distinction.

Thus at the outset it becomes necessary to determine, as well as may be, what should be regarded as generic and what as specific characters. In the living organic world it is notoriously a matter of the greatest difficulty to draw the line between many genera and many species. Nay, not only do genera seem to merge into one another, but the higher groups, orders, classes, divisions, are separated by such indefinite and indistinct boundaries, that it is very difficult, and at times impossible, to draw the line between them. If this be so with living forms, where advantage can be taken of accurate investigation and examination of extensive suites of *perfect* specimens, how much more caution should be exercised when dealing with fossils, which are so generally found in limited

numbers and imperfect condition. In many cases species have been founded on single specimens, or two, three, or perhaps half a dozen. It is much easier, natnrally, in these cases to formulate specific distinctions, but at the same time, and because of the very sparseness of the material, we become all the more liable to errors of interpretation, which only time and large suites of specimens can correct.

Species making in palæontology is largely governed by the individual. If the student has confined his attention solely to geological species, and too many have done so, he will often be unable to comprehend, and be incapable of deciding what amount of difference is required for a new species. Each trivial variation assumes specific importance to him. Individual variation becomes specific, and what a student with a wide knowledge of living forms regards as perhaps of specific value, the mere palæontologist often calls generic. There is, in fact, no criterion by which to judge fossil species, except individual opinion. We can not see the offspring of a parent exhibiting variations among themselves as we can in the living world. We can not tell how diversified may have been the forms produced from a single individual; nor can we prove by testing, how true one species may breed, or whether it will cross readily and produce hybrid offspring with another form. More especially is this the case with the lower forms of animal life, the Bryozoans, the Polyps, or the sponges. But even here the living have an advantage over the dead. For we may see on a single branch, or in a single group, various forms, which found apart, would often be regarded as specifically or even generically distinct. But when, after death, and in a fossil state, these colonies, groups or branches become broken up, there is no means of re-uniting them in the form they once had, and we are left to speculation and conjecture in regard to the relations of one part to another.*

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*New discoveries are constantly being recorded which show the truth of these remarks. In *Science* (IX, 576, May 27, 1887.) is given an account of a fine specimen of *Lepidodendron* found in New York, from which the following is taken: "It is fifteen feet in length from the roots upward, measures thirteen and a half inches in diameter across the base, three inches at the broken upper extremity, and preserves in great beauty and perfection the cicatrices of the leaves, in places the narrow elongate, lanceolate foliage and the delicate rootlets." "It is interesting to observe, that, so wide a variation exists at different distances from the base in the arrangement of the cicatrices, one cannot but feel, in examining the fossil, that, if it had been found in fragments taken from different spots, it would furnish all the necessary material for a half dozen distinct species of lepidodendron, according to prevalent methods of determining these values. Moreover, toward the base the leaves are uniformly arranged on elevated longitudinal ridges, as in Sigillaria, showing nothing of the quincunx arrangement higher up, and regarded as a diagnostic character of lepidodendron." Evidence of a similar character is given by a writer in a volume of the Annals of the New York Academy of Sciences. The same thing can be seen in the scars of leaves on the caudex of the living tree fern, the lower ones being quite different in shape from those above.

As there must be some rule to apply for the purpose of separating individuals into classes, orders, genera and species, it is necessary to examine a little into this point. When the points of difference are of minor importance, and here, too, individual opinion must come in, and the differences are more numerous than the resemblances, a separation of species is justifiable. When prominent structural differences present themselves, which are of constant occurence, new genera may be made. But when, in a large suite of specimens, small differences, which might well be characterized as individual, present themselves; or when, in a few specimens, variations are observed which might have well been individual, then new species should not to be made for a few abnormal forms. For example, when a form presents certain characters which are intermediate between two other previously considered distinct species, it would be better to unite the three into one instead of having three separate names. So, too, genera connected by links of this sort should not be kept asunder, but combined under one, the earliest, name.

Unfortunately this has not been the case in the study of the species of the difficult group of fossils under consideration. Indeed, in one conspicuous case it has been the exact reverse. Species have been made, genera have been formed, when the characters of the specimens were so exactly intermediate between two previous known species or genera, that they were obviously linked together by the new discovery. We are well aware that objections have been urged against the union of any two forms presenting even small differences.* Yet in an investigation such as will here be attempted, it will be better to take a broader view of the meaning of species, and include under it the forms which do not seem to be anything else than variations in individuals, not yet sufficiently pronounced to be raised to the rank of species.

All who have written upon the Monticuliporoids have felt and have referred to the difficulties with which they have had to contend. The immense numbers of specimens seems to have led to wonderful diversity in development, and the difficulty has been increased by the very quantity of material. At first the majority of the species of the group were referred to the genus *Chætetes*, Fischer. This was done in 1875 by Dr. Nicholson, in the second volume of

*As an instance of this in Botany we find the species *Rubus fruticosus* credited in England with about 75 different forms, all of them having distinct names. (Hooker, Student's Flora, p. 114). A somewhat analogous instance is found in Palæontology with *Orthis lynx*.

the Palæontology of Ohio. Subsequently,* this authority modified his opinion as to the proper generic name, and substituted *Monticulipora.* He was well aware of the variability of the species of this genus, for he says† in a sort of preface to his descriptions: "Some of the species hereafter described are nearly allied to one another, and in other instances individual specimens may be found which seem to stand midway between two species, and cannot readily or definitely be referred to either. This would give countenance to the belief that future researches might ultimately enable us to unite some of these so called species under one or more highly variable specific types."‡

The great extent of the group has resulted in various attempts to arrange them into subordinate groups but with little success. The two prominent examples of this division are Dr. H. A. Nicholson,§ and Mr. E. O. Ulrich.|| Their methods and their ideas show a wonderful difference.

Dr. Nicholson, for example says that from a strictly scientific point of view "the family of the *Monticuliporidæ* must be regarded as comprising only the single genus *Monticulipora*, D'Orb." He then states that he had formerly divided the genus into six sub-genera, and, that while there was no difficulty in framing a generic description which would cover all the six, yet three of them were easily separable from the rest by certain well-marked structural features. He then says that "upon the whole, therefore, it may perhaps be the best plan, as a matter of *practical convenience*, to regard these three groups as so many distinct *genera*, in spite of the fact that they have no theoretic claim to such a rank." If this be adopted, the genus *Monticulipora* is then sub-divided into five sub-genera and three other genera are formed for convenience.

The other plan, that advocated by Mr. Ulrich, runs to another extreme, and instead of the modest number of three genera and five sub-generic groups, he would have no less than twenty-nine distinct genera and one sub-genus, seventeen of which he coins himself, and hardly two of which does he admit to be more than slightly related. The course which will be pursued in the present paper will be different from either of these. It will follow the

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*More particularly in "The Genus Monticulipora" published in 1881.

†Palæon. of Ohio, II, p. 190.

‡The difficulty of classifying these "half-way" species is felt by all who have collected large suites of specimens of variable genera. One of us has kept a box into which the puzzling forms are put as they are encountered, and it is wonderful how rapidly they accumulate. In the present paper we shall try to show cause why many of the reputed species should be united under some older and variable species.

§The Gens Monticulipora, 1871, 90 et. seq.

||American Palæozoic Bryozoa. Jour. Cin. Soc. Nat. Hist., 1882-'83. Vol. V. VI.

"theoretically" correct idea of Dr. Nicholson, that all the species be grouped under the one genus *Monticulipora*, with such subdivisions or sub-genera as seem best suited to the exigencies of the case, and which will best enable students and collectors to gain an accurate knowledge of the group.

There have been recognized of the typical genus *Monticulipora* as it will here be considered, and as it is represented in the Cincinnati Group, six separate and more or less distinct types. These are as follows, chiefly, if not solely, separated by external characters:

First. *Massive species.* In these the corallum is generally attached by one point at the base, and is more or less spherical, globose or lobate.

Second. *Discoid species.* In these the corallum is a free, more or less plano-convex or concavo-convex disk, with the upper surface occupied by calices, and the lower with a striated or wrinkled epitheca.

Third. *Dendroid* or *Ramose species.* In these the corallum is branching, more or less, the stems are cylindrical or sub cylindrical, the base free or attached, and the surface of the branches covered with the calices. The extremities of the branches are rounded. Some are very slender, some more or less swollen, and some few seem to occupy an intermediate place between this and the massive group.

Fourth. *Laminar or Frondescent species.* In these the corallum is expanded and flattened, generally formed of two layers of corallites diverging from a central axis.

Fifth. *Encrusting species.* In these the corallum forms a crust, growing parasitically on the shells of brachiopods, cephalopods, gasteropods, etc., or on other corals.

Sixth. Forms taking their shape apparently from the form of the body upon which the corallum has grown, generally very constant in each individual species.*

The surface characters of the species of the genus can be explained in a few words: "Monticules," consisting of a number of cells more or less elevated above the surface of the corallum, and conical or oblong in shape. "Maculæ," formed of a cluster of larger or smaller cells on or below the surface; and, lastly in some instances an epithecal membrane, either spread over a portion of the cell bearing surface, or covering the entire under surface as in the species of the *Discoid* group. In some species it is wrinkled,

*Nicholson, The Genus Monticu., pp. 34, 36.

in others striated; sometimes it is very thin, and at other times strong and thick. The form of the cells, as visible on the surface, varies from round to polygonal and in one species, (*M. quadrata*) the cells are rhombic or square.

All these, the general form of the corallum, the surface features, and the form and arrangement of the calices, have been considered by some of the recent students of the *Monticuliporoids*, to be almost valueless. This is especially insisted upon by Dr. Nicholson, who, in both his "Palæozoic Tabulate Corals," and his "Genus Monticulipora," asserts time and again that the form of the corallum has no classificatory value. Two quotations must here suffice to show this. He says: " . . . . it is quite certain that the mere *form* of the corallum, though affording a useful guide to the collector, is usually of no value whatever in determining the structure and affinities of a given specimen of *Monticulipora*. As an illustration of this fact, I may mention that among the corals which, from their general form and superficial characters, would unhesitatingly be placed under the well known species *M. petropolitana*, I find at least three well marked types to be included, which differ so widely from one another in minute structure, that they might well be regarded as at least distinct sub-genera." After stating this, he goes on as follows, to show that *sometimes*, at least, the form of the corallum is of use in determinations. "At the same time certain species, and especially those which have a laminar or frondescent corallum, are very constant in their mode of growth, so that in these cases the form of the corallum is of value in the determination of species; while the ramose species, however variable, never appear to form crusts on foreign bodies, as some of the massive species occasionally do."* In another place and in another book Dr. Nicholson writes thus: " . . . we are obliged to conclude that the mere external shape of the corallum is a character of no classificatory value. It is not that individual species are specially variable in shape, for many types exhibit a tolerably constant form when adult; but it is the fact that so many structurally diverse species assume the *same* shape that robs this feature of any special value it might otherwise possess."†

Other quotations besides these might be given, but they will be enough to show the small value said to be placed upon external form of the corallum. Before examining into the features which *are* relied upon by Dr. Nicholson and others, Mr. Ulrich among

*Tabulate Corals, p. 273. †Genus Monticu., p. 33.

them, we wish to call attention to the fact that the external features are not only relied upon by these two authors, but in some cases they are the only ones considered to be of value. We shall proceed to show how this is the case by quoting from the descriptions of various species by both Dr. Nicholson and Mr. Ulrich, as follows:

"The most obvious feature which separates the latter [*Constellaria*] from the genus *Fistulipora* is its possession of the conspicuous star shaped monticules which adorn the surface of the corallum."* This is an external feature, and one used to separate two genera. Again: "It cannot be denied, however, that the separation of *Dekayia* from *Monticulipora*, so far as our present knowledge goes, is purely arbitrary, and is only defensible upon the ground that its surface columns constitute a marked external character, by which its species can be readily and conveniently distinguished as a group apart."† Here we have not a species, but one sub-genus separated from another on an external feature. Again: Superficially *M. nodulosa* is said to be "readily distinguished by its minute size and the numerous well defined monticules which cover the surface."‡ *M. o'nealli* "is readily recognized by its slender, cylindrical, smooth branches, its regularly oval, vertically arranged calices, and the presence of numerous interstitial apertures between the upper and lower ends of the large calices."§ In *M. irregularis*, the "small size, apparently free habit, and nodulated surface, are well marked external characters, though, according to Ulrich, the surface may be nearly smooth."|| *M. quadrata* is readily distinguished superficially "from other dendroid species of *Monticulipora* by the commonly rhombic or diamond shaped form of many of the calices, these openings being then arranged in curved diagonal lines, which cross each other obliquely."¶ "In internal structure *M. clavacoidea*, James, is most nearly allied to *M. irregularis*, Ulrich, but the form of the corallum and the mode of growth afford a sufficient means of separation."° The peculiar helicoidal shape of *M. calceola*, "and the fact of its being built round a curved central tube which opens externally by a round aperture, would alone distinguish the species, quite apart from its internal characters."*a* In *M. briarea* "the peculiar form and mode of growth of the corallum . . . . taken alone, would render its distinctness highly probable."*b* In his description of *M. parasitica*, which we shall

*Nicholson. Genus Monticu., p. 98.
†Ibid p. 99. ‡Ibid, p. 117. §Ibid, p. 119. ||Ibid, p. 178. ¶Ibid, p. 180. °Ibid, p. 185. *a*Ibid, p. 186. *b*Ibid, p. 199.

consider a synonym of *M. papillata*, Mr. Ulrich says that he regards his new species as more nearly allied to *M. cincinnatiensis* than any other species, but that "the larger, more closely arranged, and much more prominent monticules of that species, constitute a point of difference so decided and readily apparent, that examples of the two species may be distinguished at a glance."* In another place after describing two forms, closely allied, he says: "In its typical form this species may be readily distinguished from the preceding by its tuberculated surface. The more nearly smooth examples can be distinguished by the thicker walls, stellate maculæ, and much more flattened branches of *H. curvata*" [the first one described].† After describing *Prasopora nodosa*, which will be by us considered a synonym of *M. cincinnatiensis*, James, he says: "The strongly tuberculated surface, and the irregular growth of this species will distinguish it from all other species of *Prasopora* known to me."‡

Instances like the above can be multiplied almost indefinitely, but these must suffice, and we refer all who wish to see other cases to the volumes quoted.§ But if now, there be such objection to using the form and external features of the coralium for distinguishing the species of *Monticulipora*, upon what would these authors, and others, place dependence? The answer to this question is stated in a few words. The internal structure of the species, as revealed by thin sections examined under the microscope, is to tell us the name of the specimen we have in hand. In other words, surface features are to be largely, if not wholly disregarded, and if we desire to identify any one *specimen*, positively, be it ever so small, or ever so well marked externally, we are expected by reason of these "modern methods," to cut into sections, polish, mount and examine under a compound microscope each specimen we have to handle. It is as if an anatomist were to laboriously make

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*Am. Pal. Bryozoa, Jour. C. S. N. H. v., 239.

†Ibid, p. 244. ‡Ibid, p. 245.

§If these writers, and others, consider the external features to be of little or no classificatory value, the question might be asked, why is it that in every case of original description of a species, the external form and markings are nearly always referred to first, and minutely described? If of no value, why be at such pains to mention them? But further the question might be asked, what would be the value of the description of highly magnified sections of the interior, if nothing were known of the exterior of the species? Mr. Ulrich asserts positively that he "for one will not recognize any of the recent publications (preliminary publications of work done for delayed state surveys, etc., alone excepted), in which the names proposed are not clearly defined, and the specific character of the fossils figured." (J. C. S. N. H. v. 247). Yet Mr. Ulrich himself has made descriptions and given figures which are impossible to recognize. In his Am. Palæozoic Bryozoa J. C. S. N. H. v. vi, vii), on fourteen plates he has 260 figures. Out of these only 50 are of natural size and at all recognizable; all the rest are magnified sections of the interior or exterior, enlarged generally eighteen diameters, and sometimes fifty. All of these highly magnified figures would be utterly worthless without the description of the exterior.

an examination of each bone in the skeleton of an unknown animal, and if he found a rib which differed slightly from another rib, he were to make a new genus for it or coin a new specific name. Perhaps a more analogous instance, however, could be taken from the vegetable kingdom. Let us suppose a branch of a tree to become so perfectly petrified as to retain all the tissues in the same state as when it was alive. Then suppose this branch to be broken into pieces and scattered over the ground. If a person were now to examine a piece from near the small end of the branch, and compare it with one from the larger end, the outside would present the same appearance in each. But a minute microscopical examination would reveal tissues in the piece from the larger end, of a complicated structure, while that from near the smaller end would be much simpler, and probably quite different. There would be sufficient difference to justify making two genera, if the plan adopted by Nicholson and Ulrich in studying the Monticuliporoids were adopted.* Let us now see what the internal characters, upon which so much stress has been laid, are.

First.—Each tube of the corallum always possesses a complete wall. In some instances the walls are distinct during the entire growth of the organism, but in others this is not so apparent.

Second.—The absence of the "mural pores" of Nicholson, or "connecting foramina" of Ulrich, constitutes the main difference between the ramose species of *Favosites* and *Monticulipora*. Yet even this distinction does not always seem to hold good. Ulrich says that in a special portion of a single specimen he has detected connecting foramina.† Nicholson says:‡ "The typical *Monticu-*

*Since the above was written, one of us has found in two separate notes, remarks bearing upon the value of internal features in species making, one relating to the variations in the skeletons of birds, the other the minute structure of plants. Dr Shufeldt, writing in *Science*, (IX, p. 416, April 1887.) says after referring to certain marked differences which appear in the skulls of birds of the same species, that in the light of the examples given, "the entire ground may be covered by saying that in all forms, both vertebrate and invertebrate, palæontological and otherwise, when we come to compare sufficiently extensive series represented by individuals of the same species, we will find in similar structures marked variations, both as regards relative size and form as we pass from one specimen to another, and if extremes be chosen, the differences will be found to be in many cases of very striking nature." Again in a notice of a recent book by J Felix, "Die fossilen Holzer West Indiens," the reviewer remarks that to show the little dependence to be placed upon identifying species on the minute structure of the wood by means of microscopic sections, that from a "personal examination of over 400 living species, belonging to various families, the author concludes that a study of the histological structure alone is not in general sufficient for the identification of genera or species, since, as he says, different species of the same genus may differ so extraordinarily in their structure that, should one have them before him only in a fossil state, they would never be referred to the same genus. Again, species of different genera may so much resemble each other, that if known only in a condition of fossilization, they would undoubtedly be referred to the same genus." (Botanical Gazette, vol. XII, pp. 90-91, April 1887). The same remarks would, it seems to us apply equally well to the internal structure of such lowly organized forms as the Monticuliporoids.

†J. C. S. N. H., v. 124.

‡Tabulate Corals, p. 271.

liporæ seem to be undoubtedly devoid of mural pores, but I have examined . . . . a specimen from the Wenlock Limestone of Dudley . . . . which has all the external and general characters of such a *Monticulipora* as *M. petropolitana*, but in which the walls of the corallites are unquestionably minutely porous."

Third.—It is noticed that there is a difference between the young and the old parts of the corallum, which may be called respectively the immature and the mature portions.* The walls commence thin and apparently indivisible. This portion in the ramose and frondescent forms occupies the deeper regions, and terminates at or very near the point at which the tubes bend abruptly to the surface. Here the diaphragms are often wanting, and are always more remote than in the mature region. Cystoid diaphragms and spiniform tubuli, (the spiniform corallites of Nicholson,) are never developed, nor are true interstitial tubes, these appearing only in the mature region. The peripheral portion in the great majority of forms, differs more or less from the immature region. The tubes bend outward, the walls become more or less thickened, and if at all, the cystoid diaphrams, interstitial tubes, spiniform corallites and mural pores are developed. The diaphragms become more numerous and appear to be of a different character.

The thickening of the walls of the tubes is one conspicuous feature of the mature portion, accompanied either by the addition of concentric, or obliquely arranged and overlapping layers. This addition of matter may take place continuously and regularly, or periodically. It is not so easy to detect the two regions in the massive as in the ramose and frondescent forms, since in some of the massive ones the walls of the tubes remain thin, the diaphragms are remote, and neither interstitial cells, nor spiniform corallites are developed. In specimens of *M. filiasa*, for example, there are sometimes many successive immature and mature zones, the first marked by thin walls and remote diaphragms, and the other by slightly thickened walls and crowded diaphrams.

From this we gather that there are two layers in each corallum; one, the immature, characterized by thin, indivisible tube walls and few diaphragms; while the other, the mature, has the walls often thickened, and cystoid diaphragms, spiniform corallites and interstitial cells developed. Sometimes opercula, with a central open-

*The following is condensed from Mr. Ulrich's account, in Jour. C. S. N. H., v. 125-7.

ing, close the mouths of cells, each operculum eventually forming the base of a new cell, the central foramin being closed.

Fourth.—Certain smaller cells or tubes are known as interstitial. These have distinct walls, and at the same time have more numerous diaphragms than the other tubes. The diaphragms are always complete and approximately straight. While in the subgenus *Fistulipora* the corallites are separated from each other by interstitial tubes, in the true *Monticulipora*, the larger tubes are, to some extent in contact, and the tabulæ of the smaller tubes do not become vesicular. "At the same time," says Dr. Nicholson, "it must be admitted that there are some species of *Monticulipora* which make a close approach to *Fistulipora*, and that it is not always an easy matter to separate the two genera."*

Fifth.—Spiniform corallites or tubuli, are blunt, spine-like structures, placed either at the angles of junction of the cells, on the line separating adjoining cells, or included in the walls of the cells. These are found in a large number of species of *Monticulipora*, but can not be regarded as of classificatory value.† This is also the case with opercula, as "it does not appear that the opercula are developed in any uniform manner, some parts of the surface showing these structures, while in other parts the calices are open."‡

Now as the external features have been condemned by Messrs. Nicholson and Ulrich, the two special workers in the field so often quoted, and they lay such stress upon the internal characters, let us see if these can be depended on to any greater extent. We think it can be shown that these features of the Monticuliporoids are as unsatisfactory as the external ones are to them. To our minds they are much more unsatisfactory, because they entail an immense amount of work which in the end seems to amount to very little. The extracts following will give an idea of the little dependence to be placed upon species based solely, as some have been, on internal structure. In speaking of the separation of two genera, Dr. Nicholson says; "There is, indeed, no feature in the way of internal construction which could be brought forward as separating *Striatopora* from *Pachypora*; and in distinguishing these two types we have to fall back upon a well marked external character."§ In the following case peculiar external form is connected with peculiar internal structure, and the former circumstance is generally relied

*Genus Monticu., p. 97. †Ibid, p. 49. ‡Genus Monticu., p. 55.
§Tabulate Corals, p. 99.

upon in separating the species. In *Alveolites suborbicularis* the peculiar habit of forming irregularly gibbous masses, composed of successive concentric strata enveloping some foreign body "is only found in specimens which have a special internal structure; under these circumstances it becomes a character of specific value."* Again the same is the case with two species of *Columnaria*, *C. calicina* and *C. alveolata*, and the external feature alone is useful in making the separation.† Take again the following: "It would appear, ... that so far as at present known, there is nothing in the internal structure of *Cladochoma*, McCoy (= *Pyrgia*, E. & H.,) which would separate it from *Aulopora*, Goldf., and the generic distinctness of the two can only rest upon the feature that the corallum of the former is erect, whereas in the latter it is creeping and parasitic."‡ In speaking of the differences between *Dekayia* and *Monticulipora* the same authority states that the general nature of the corallum is the same in each, "and the only feature that would strike the observer is that the surface of the former is studded with little quadrangular spines or columns, interspersed in great numbers among the ordinary tubes of the corallites."§ Between *M. ramosa* and its variety *rugosa* there are striking external differences, yet "the more minute external and internal characters of *M. rugosa*, are precisely similar to those of *M. ramosa*."‖ Under the name of *M. undulata*, Dr. Nicholson places two forms having the same internal structure, but being very different in form. One forms "large, lobed or laterally indented masses"; the other is smaller, hemispherical or spheroidal, "of from half an inch to more than an inch in diameter."¶ So, too, with Mr. Ulrich's species. In the description of *M. consimilis*, which we shall place as a synonymn under *M. cincinnatiensis*, he says the internal structure is almost exactly like his *M. lævis*, which we shall place as a variety of *M. hospitalis*, Nich.° These are by no means the only examples which could be quoted, but they will show that the internal structure is not a more infallible guide than the external one, besides laboring under the additional disadvantage of requiring a much greater amount of work, which may, in the end, prove valueless. For the purposes of discrimination of species, therefore, mainly the object of this paper, the authors shall lay stress upon external features, believing it better to take obvious features rather than

*Ibid, p. 127. †Tabulate Corals, p. 198. ‡Ibid, 223.
§Genus Monticu., 98, 99.
‖Genus Montic. 114.
¶Ibid. 172-73.
°J. C. S. N. H. v 238.

those which are obscure. More especially do we believe this the better course because of the uncertainty and unreliability, as well as the difficulty of studying thin, microscopic sections.*

The type species of the genus *Monticulipora*, D'Orb, has been the subject of considerable discussion. Dr. Nicholson thinks that D'Orbigny had before him at the time the description was made, one of four species which, externally very similar, were, internally very different. He concludes that a common form growing in "thin undulated fronds, ... with its surface covered with monticules, which are sometimes low and rounded, sometimes conical, sometimes elongated," should be considered as the type and be called *M. mammulata.*† Mr. Ulrich on the other hand‡ considers that the form regarded by Nicholson as the type of the genus is really what collectors at Cincinnati have always called *M. frondosa*, and that the true *mammulata* of D'Orbigny has been described by Dr. Nicholson under the new name of *molesta*. It must be confessed, however, that the selection of one is a matter of individual opinion, and one person is as likely to be right as another. It is worthy of note, however, that the two species *mammulata* and *frondosa* are easily separable upon a character which is revealed by a rough fracture, as will be pointed out later on.

The zoological position of the Monticuliporoids, is a question which has been discussed from two sides, one party considering the

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*It will be well in this place to give some idea of the manner of preparing these thin sections; this is as follows: In many cases three different sections are made to study the internal structure of any specimen. These are called *tangential*, *longitudinal* or *vertical*, and *transverse*. In making *tangential* sections, the surface of the specimen is grouud off just enough to get below the mouths or apertures of the tubes or corallites, cutting these at right angles with their long axes, care being taken to have the surface perfectly level, and cut directly across the tubes. As most of the *Monticuliporæ* have a more or less convex or undulating surface, some of the tubes, *i. e.*, the central ones on the highest part, will unavoidably be cut lower down than some others. In consequence of the undulating surfaee, some of the tubes are not cut directly across, but more or less diagonally. After grinding, the surface must be polished to free the section from scratches, and it is then cemented, polished surface down, by means of balsam to a glass slide. Then the other, free, side is rubbed down the same way, until the section is as thin and transparent as it is possible to make it and not destroy the internal structure. This side is then polished in its turn, and then covered with a thin cover glass, or occasionally simply flowed with balsam; the former is the better. It is then ready for the microscope.

The process is the same in making other sections. The *vertical* section is cut in the long direction of the tubes, from the central axis to the surface. As the corallites are seldom in straight, parallel lines, but are more or less curved, wrinkled or undulating, they are liable to be cut in one or more directions, so as to make it difficult to trace the walls continuously from the base to the surface.

The third kind, *transverse*, at exact right angles with the long axes of the corallites, are sometimes made at various distances from the surface.

The tabulæ, or diaphragms, seldom pass in a perfectly horizontal direction across the tubes from one side to the other. Some are diagonal, some are curved more or less, some form what Dr. Nicholson calls "lenticular vescicles," attached to only one wall of the tube. In making tangential sections, some of these oblique or curved tabulæ are cut away in the centre, leaving an apparent perforation in the middle of the tube. Others, when cut away on one side leave a crescentric line in the tube, so that tangential sections of the same species may present very different appearances.

†Genus Monticu., p. 108. ‡J. C. S. N. H., v. 133.

group as Corals, and the opposite as Bryozoans. We shall consider them as corals, and before taking up the individual species, desire to make a few remarks upon the families into which the group has been divided, for the group is an eminently natural one, and the families quite as eminently artificial. The distinctions upon which these families have been based are trivial in the extreme; so much so indeed that they are the merest superficial characters, which, in many another case, would scarcely be considered generic. We therefore propose to wipe them all out, and reduce two families *Fistuliporidæ* and *Ceramoporidæ* to the one main one *Monticuliporidæ*.* We shall show, however, the grounds upon which this is done, by pointing out the characters said to distinguish each, arranging them in parallel columns, and putting in *italics* those features common to two or all. In this way we may see how little reason there is for making more than the one family.

MONTICULIPORIDÆ.	FISTULIPORIDÆ.	CERAMOPORIDÆ.
Corallum sub-massive, incrusting, *ramose* or *frondescent*. Branches solid or *hollow*. Surface smooth or with monticules.	Corallum massive, *ramose or frondescent*.	Corallum *incrusting*, or *ramose*, with *hollow* branches or flabellate.
Cell apertures *ovate*, *circular*, polygonal or quadrate. *Interstitial cells present* or absent.	Cell apertures, *ovate* or *circular*, *with* or without *projecting lips*, separated from one another by *interstitial cells*.	Cell apertures triangular or *ovate* with *prominent lips* on one side. *Interstitial cells few or many*.
Diaphragms straight.	*Diaphragms straight*.	*Diaphragms*, (*if any*) *straight*.
Mural pores sometimes present. Spiniform corallites present or absent. Cystoid diaphragms present or absent.		*Mural pores sometimes present*.
Vesicular tissue sometimes present.	*Loose vesicular tissue generally present*.	*Vesicular tissue* in *Eridopora*, Ulrich.

If now we analyze these three families, we are immediately struck with the similarity in all. The general form of the corallum is the same. The cell apertures are similar, the projecting lips

*The first two of these were established by Mr. E. O. Ulrich, in 1882. See J. C. S. N. H., v. 156. The third was used by Nicholson in 1879, see Tabulate Corals, p. 255.

being apparently absent in *Monticuliporidæ*, but present in both the others. Interstitial cells may be absent or present in *Monticuliporidæ*, but are found in both the others. Diaphragms in all are similar. The main feature of the *Fistuliporidæ* is found in the vesicular tissue of the interior of the cells, but this is also found in certain species of *Monticuliporidæ*, as noticed by Nicholson in his sub-genera *Prasopora* and *Peronopora** and in *Eridopora*, as given by Ulrich, one genus referred to *Ceramoporidæ*.† The remaining features are too slight to characterize orders upon, and consequently we propose to disregard these altogether, and place all the genera and sub-genera which are to be regarded as valid, in the one family.

MONTICULIPORIDÆ, Nicholson.

Let us now examine the various genera which have at times been proposed for members of this family, and see if the grounds for their formation are well established.

Heterotrypa, *Diplotrypa* and *Monotrypa*, were proposed by Dr. Nicholson in 1879‡ for examples of *Monticuliporæ*, which were to be separated as follows: In the first, *Heterotrypa*, the corallum has two kinds of tubes, one larger than the other, and both of which have the walls thickened toward the mouth, the apertures being sub-polygonal or rounded. The second, *Diplotrypa*, also has a corallum with two kinds of tubes, both of which have *thin walls* at the surface, and are angular or prismatic; the larger corallites are, further, generally gathered into clusters, and form monticules, more or less conspicuous. And in the third one of these, *Monotrypa*, the cell apertures seem to be all of the same size, have thin walls, and occasionally, a few of a slightly larger size are gathered into monticules. The walls, however, are sometimes thickened, but there are no interstitial tubes. These external features are correlated with certain internal ones, which are only to be studied by microscopic sections, and as it is the object of this paper to furnish descriptions which will enable students to identify species by macroscopic instead of microscopic examination; and as in two other genera while the external features are like one of the above, the internal ones are different, it is deemed best to disregard these three sub-genera and endeavor to arrange the species on another plan. The two others referred to above are *Prasopora*,

*Genus Monticul., pp. 202–215. †J. C. S. N. H., v. 157.
‡Tabulate Corals, pp. 291–293.

Nich. and Eth., Jr., 1877, and *Peronopora*, Nich., 1881. The first of these, *Prasopora*, was at first regarded as a genus distinct from *Monticulipora*.* But afterward,† it was reduced to the same rank as the others, and regarded as a sub-genus. It, like *Diplotrypa*, has two kinds of corallites, large and small, and these have their walled tubes, also as in *Diplotrypa*, and the genus is mainly separated from the others by having internally a number of vesicular spaces along the tube walls, in addition to nearly horizontal tabulæ. Finally, in *Peronopora*, we have the same dimorphic corallum, this time with thickened walls, and also the vesicular internal structure.‡ At the present writing we think these sub-genera had better be abandoned.

We come now to examine the characters of a host of genera proposed by Mr. E. O. Ulrich in his papers on "American Palæozoic Bryozoa."§ As the title of his papers indicates, Mr. Ulrich regards the *Monticuliporoids* as *Bryozoans*, a position in which we do not follow him, and which opens up a question already referred to, and which can not be properly discussed here. We shall examine the descriptions which he has given of these new genera, and think that we can show that none of them are of sufficient value to stand.

Monotrypella, Ul., is defined as being "ramose, smooth or tuberculated, cells apparently of one kind only. Walls very thin in the axial portion of the branches, but much thicker in the peripheral region. Diaphragms straight. No spiniform tubuli" [corallites].|| The resemblance to *Monotrypa*, Nich., is seen in the one kind of corallites, and the difference is only the thickening of the cell walls at the mouths. This occurs in so many genera, and in such varying degrees, that of itself it can not be considered of any importance. Taken in connection with the one kind of corallites, it approaches too closely to *Monotrypa*, especially as in the diagnosis given by Nicholson of his genus, it is stated that in some cases the walls of the corallites are appreciably, or even considerably, thickened; but they always preserve in such cases the original lines of demarcation separating the adjoining tubes."¶

Amplexopora, Ul., differs only from *Monotrypella* in having

*Am. Nat. His., Ser 4, XX., 388. Pal. Tab. Cor., p. 324.

†Genus Montic., 202.

‡Ibid, p. 215.

§J. C. S. N. H., V. VI. 1882-83.

||J. C. S. N. H. Ibid V., p. 153.

¶Genus Montic., p. 168.

spiniform corallites more or less numerous.* These of themselves can be regarded as of no value in a generic sense, as they are found in forms of various affinities, and are at times numerous or nearly absent in the same genus.†

Batostoma, Ul., differs solely from *Monticulipora* in having the cells surrounded by a ring-like wall,‡ a good specific character, may-be, but not a generic one.

Batostomella, Ul., agrees with *Monotrypella* and *Amplexopora* in having thickened walls, but differs in having interstitial tubes,¶ thus approaching *Diplotrypa*, Nich.

Leioclema, Ul., differs from the previous genus mainly by the much greater number of interstitial cells, "two or three series of angular interstitial cells" separating the main cells.§ In this it approaches *Fistulipora*, McCoy, one of the main features of which is that these small cells are arranged in one or more series. *Leioclema* is a Carboniferous genus, but should nevertheless be referred to *Monticulipora*. The number of these interstitial cells is most variable in the same genus, being even in those of Mr. Ulrich's coinage described as "more or less numerous" (*Batostoma*); "few to numerous" (*Batostomella*), and so on. They alone can not be regarded as of any generic value.

Atactopora, Ul., is an incrusting form, the surface bearing monticules, the cell apertures with one to three rows of blunt spines, the interstitial cells gathered into clusters or scattered, etc.|| Here we find features which are so variable, and which are found in so many other forms, that they are robbed of all generic value.

Callopora, Hall, is regarded as a synonymy of *Fistulipora*, McCoy, by Nicholson.** Mr. Ulrich says Dr. Nicholson is mistaken, and shows by figures the differences between the two.†† In external features *Callopora* resembles *Fistulipora* in having the large corallites completely surrounded by the smaller, interstitial tubes; but it differs from it and resembles *Monticulipora* in the cell apertures not being provided with a projecting lip. As this last, however, may or may not be present, it would seem best to unite *Callopera* with *Fistulipora* rather than with *Monticulipora*.

Calloporella, Ul., is characterized on the mode of growth,

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*J. C. S. N. H., v, p. 154.
†Consult Nicholson. Genus Montic, pp. 19-48.
‡J. C. S. N. H., p. 154.
¶Ibid V., p. 154.
§Ibid. p. 154.
||Ibid V. 154. Redefined and Restricted, vi, 245.
**Pal. Cor., 304. Genus Montic., 91.
††J. C. S. N. H., v. 250.

thick walled tubes, separated from each other by "one or two rows of angular interstitial cells."* As the mode of growth can not be used as a generic character, and as thick walls, interstitial cells in rows, and spiniform corallites are found in other genera (*Lieoclema*, for instance, as well as others), neither can these be of any use for this purpose.

Aspidopora, Ul., forms very thin expansions with a concentric and radially striated epitheca on the lower surface, and with an upper surface composed of "from one to many unequal convex spaces," the cells gradually increasing in size from the margin to the center of each space.† Obviously, the striation of the under surface, the difference in the size of the cells, and the "unequal convex spaces," are not *generic* characters, though they might be good *specific* ones.

Dekayia, Ed. and H., has long been a recognized genus of the group, though the grounds upon which it is separated from *Monticulipora* are, according to Dr. Nicholson, "purely arbitrary," and consist mainly in the presence of numerous well marked spiniform corallites, projecting above the surface of the cell apertures.‡ It may be allowed to stand at present as a sub-genus.

The same can not be said of *Dekayella*, Ul., for this has interstitial tubes (wanting in *Dekayia*,) and a greater number of spiniform corallites,§ a character found also in *Batostoma*, *Batostomella*, *Leioclema*, *Atactopora* and others.

Petigopora, Ul., is proposed for certain species forming small, irregular patches on the surfaces of shells or corals, the main characters being "(1) the large and numerous spiniform tubuli; and (2) the limitation of the growth of colonies to small individual patches, which if brought into contact by lateral development, do not fraternize, but either raise a non-poriferous barrier, or have a narrow, unoccupied space between them."‖ Here, again, we have habit and the uncertain spiniform corallites made to characterize a genus, and again we protest against making specific characters equal to generic ones.

Nebulipora, McCoy, presents no features to distinguish it from *Monticulipora*, and it, with the others, is reduced to a synonym. Dr. Nicholson considers it to be "unquestionably congeneric" with *Monticulipora*.¶

*J. C. S. N. H. v., 154.
†Ibid v., 155.
‡Genus Monticu. 99.
§Ulrich *loc cit* v. 155.
‖Ibid vi., 156.
¶Genus Montic. p. 2.

Discotrypa, Ul., again, is mainly distinguished by its habit, forming "free and very thin circular expansions," "cells arranged regularly," "with rhomboidal or hexagonal apertures,"* all of which are too uncertain, and too slight characters to establish a genus upon.

Spatiopora, Ul., includes species which are incrusting, which have very thin, irregular apertures, few interstitial cells, and generally large spiniform corallites,† and again must the name be reduced to a synonym.

Stellipora, Hall (1847), is no doubt a synonym of *Constellaria*, Dana (1846). Mr. Ulrich endeavors to separate them on the grounds that the interstitial cells are longer in one than in the other, springing in both cases, however, from near the base.‡ Furthermore, he considers the fact that in the one case we have an incrusting form, and in the other one, which grows in a flabellate manner, that we have another cause for separation. It is a good specific but not a generic distinction. To give, then, the main feature of *Constellaria*, Dana, it is sufficient to say that whether incrusting or branching, the presence of the peculiar stellate maculæ, with radiating elevations which the surface presents, is sufficint to identify this sub-genus, as it shall be here considered, at once, from all the others.

Fistulipora, McCoy, is chiefly distinguished from *Monticulipora* by the larger cells being surrounded by one or two rows of smaller, angular cells, both of which have thin walls; and further, by the internal structure being more or less vesicular.§ These features seem scarcely more than enough to constitute a sub-genus.

Didymopora, Ul., was separated from *Fistulipora* on two minor internal features, but was apparently subsequently abandoned in favor of *Lichenalia*, Hall,|| so that nothing further need be said on this score.

Ceramopora, Hall, has been generally regarded as a Polyzoän genus, both by Nicholson.¶ and by one of us,** as well as by others, but it seems to be so closely allied to the genus *Monticulipora*, both in external and internal features, that we shall place it in the family, provisionally, at least. It may be either incrusting or branching; the cells are of various forms, oval to triangular,

*J. C. S. N. H. v. 155
†Ibid v. 155.
‡Ibid vi. 265-7
§Nicholson Genus Montic, 92, 93.
||J. C. S. N. H. vii., p. 43.
¶Genus Montic., 86
**Palæontologist, pp. 5 and 12; also Ulrich J. S. N. H. v., 156.

but all have an oblique aperture, and are provided with a lip. The interstitial cells are few, and mural pores are sometimes present. Enough features exist to make it a genus distinct from *Monticulipora*, but hardly enough to exclude it from the family.

The same can not, however, be said of *Ceramoporella*, Ul., for in this the distinctions are numerous interstitial cells, covered in the mature state by a thin membrane.* It should be regarded as a synonym of *Monticulipora*.

Cheiloporella, Ul., has never been fully characterized, and the features given for it, "heavy crusts, or rising upward into flabellate fronds, tubes long, traversed by few straight diaphragms, cell apertures ovate, interstitial tubes numerous,"† are too few, and too variable to be of value, so it, too, is reduced to a synonym.

Crepipora, Ul., is evidently synonymous with *Ceramopora*, Hall, the cell apertures being oblique, with a projecting lip, few interstitial cells and few diaphraghms.‡

Eridopora, Ul., is externally like *Ceramoporella* and internally like *Fistulipora*, thus forming a sort of connecting link between the two genera, but as it is a Sub-Carboniferous genus we will not be especially concerned with it just now.

The larger number of these generic names have been coined and defined by Mr. Ulrich in a scheme of classification published in the volumes so often alluded to. In subsequent papers of the same series, other genera were proposed, some were abandoned, and some old ones subdivided into new ones. The following were the later characterized genera :

Homotrypa, Ul., was a name given to certain species which he had before referred to *Trematopora*, Hall. The features of the new genus are the mode of growth, thickened walls in their outer portion, and the presence of mural pores.§ If these latter are really present, it would perhaps be a reason for establishing a new genus. The fact is, however, that the forms referred by Mr. Ulrich to his new genus have long been recognized members of the old genus, and no reason exists for any change of generic name.

Leptotrypa, Ul., was established for the reception of certain species having thin, incrusting corallums, polygonal, thin walled cells, of one kind only, and with small spiniform corallites occu-

*Ibid v., 157.
†Ibid 157.
‡Ibid p. 157.
§Ibid v., 240.

pying the angles of the cells.* For lack of sufficient characters it will be reduced by us to a synonym.

Atactoporella, Ul., again, was formed for certain parasitic forms, previously referred to *Atactopora*. The grounds for this new genus are even more slight than those upon which the other had been founded. The differences between the old and the new genus are thus referred to: "The new genus differs from *Atactopora*, as before restricted, in having numerous closely tabulated interstitial cells, cystoid diaphragms in the proper zoœcia [tubes], and thin, instead of thick walls. These are all good generic characters," etc. If these constitute *good generic characters*, then it is time to raise every species to the rank of a genus, and give to each individual a specific name!

Mr. Ulrich has by no means yet lost his ardor for making new genera and species, and he continues the work in the 14th Annual Report of the Geological and Natural History Survey of Minnesota (1885). In this volume† he defines as a new genus *Homotrypella*, Ul., basing it upon a ramose corallum, with small, thickened cells, cystoid diaphragms, numerous interstitial cells, numerous spiniform corallites, and other minor characters. All of these are uncertain and inconstant, and can not be considered by us as worthy of generic rank.

In the following table we have placed the sub-genera and their synonyms under the two genera which form the family.

Family. MONTICULIPORIDÆ, Nich., 1879.

1—Genus. MONTICULIPORA, D'Orb, 1850.

Nebulipora, McCoy, 1850.
Heterotrypa, Nich., 1879.
Diplotrypa, Nich., 1879.
Monotrypa, Nich., 1879.
Prasopora, Nich., 1877.
Peronopora, Nich., 1881.
Atactopora, Ul., 1879.
Atactoporella, Ul., 1883.
Amplexopora, Ul., 1882.
Aspidopora, Ul., 1882.
Cheiloporella, Ul., 1882.
Spatiopora, Ul., 1882.
Homotrypa, Ul., 1882.

*J. S. N. H. vi., 158.
†Page 83.

Discotrypa, Ul., 1882.
Batostoma, Ul., 1882.
Batostomella, Ul., 1882.
Petigopora, Ul., 1882.
Leptotrypa, Ul., 1883.
Monotrypella, Ul., 1882.
Ceramoporella, Ul., 1882.

a. Sub-genus. DEKAYIA, Ed. and H., 1851.
Dekayella, Ul., 1883.

b. Sub-genus. CONSTELLARIA, Dana, 1846.
Stellipora, Hall, 1847.

c. Sub-genus. FISTULIPORA, McCoy, 1849.
Homotrypella, Ul., 1885.
Didymopora, Ul., 1882.
Eridopora, Ul., 1882.
Callopora, Hall, 1852.
Calloporella, Ul., 1882.
Leioclema, Ul., 1882.

2—Genus. CERAMOPORA, Hall, 1852.
Crepipora, Ul., 1882.

A formidable list of synonyms surely; and such is the confusion caused by their coinage, and such are the changes of opinion in respect to their position, that it becomes almost an impossibility to say to which one of the sub-genera some of them belong. The foregoing must, therefore, be regarded as merely tentative. As illustrating this fact, and to show the radical changes proposed, we quote from Mr. Ulrich's remarks on *Heterotrypa*, Nich. "Of the seventeen species placed under *Heterotrypa* by Nicholson, (Genus Mont. 1881) but two are, according to my opinion, congeneric, [naming them]. Of the remaining fifteen, five must be referred to *Callopora*, Hall; two to *Amplexopora*, Ul., one to *Homotrypa*, Ul., three to *Batostoma*, Ul., two to *Batostomella*, Ul., and one to *Monotrypella*, Ul."* In another place, in speaking of the sub-genus *Monotrypa*, Nicholson, Mr. Ulrich says that of twelve species referred here, four are congeneric. Two are doubtful, three belong to *Monotrypella*, Ul., one is a *Ptilodictya*, one belongs to *Amplexopora*, Ul., and the remaining one should be placed in *Spatiopora*, Ul.†

*J. C. S. N. H., vi. 83.
†Ibid v. 256.

In order to show the difficulties to be encountered in identifying some of these genera of Mr. Ulrich's, a few quotations will be given. First in reference to *Eridopora*, Ul., he says, after giving the description: "As may be gathered from the above description, the genus is exactly intermediate between *Ceramoporella*, Ulrich, and *Fistulipora*, McCoy. Externally its species resemble the former, while their external (!) [internal?] characters simulate very closely those of certain species of the latter genus."* Again in speaking of one of his new species, *Amplexopora robusta*, he says: "Care must be taken in separating the species from *Monotrypella æqualis*, Ul., which the smaller specimens of *A. robusta* strongly resemble." † Again, as showing the estimate placed upon certain well known variable features, and as illustrating Mr. Ulrich's idea of what is a good generic or specific character, we read. "I have studied two species which differ from the typical forms of the genus in one character, namely, in possessing a limited number of smaller cells than the average, which appear to be of the nature of interstitial cells. The next described species, *M.* [*onotrypella*] *sub quadrata*, is one of these. This species, in all other respects, resembles *M. quadrata*, so nearly that I am forced to regard them at least as belonging to the same genus. The other species, though quite distinct, is yet so near to *M.* [*onotrypella*] *æqualis*, that despite the interstitial tubes, I cannot regard it as belonging to another genus."‡

[TO BE CONTINUED.]

*Ibid v. 137.
†Ibid vi. 83.
‡Ibid v. 248, 249.

REPORT ON THE CINCINNATI LYCEUM OF NATURAL HISTORY,*

BY H. P. SMITH, B. SC., CUSTODIAN CINCINNATI SOCIETY OF NATURAL HISTORY.

Executive Board Cincinnati Society of Natural History:

GENTLEMEN :

I have the honor to present herewith my first report on the condition and plans of the CINCINNATI LYCEUM OF NATURAL HISTORY.

The Lyceum was organized Jan. 8, 1887, by authority of the Executive Board of the Society, granted to the custodian.

It is the object of the Lyceum to bring together the young people of Cincinnati and vicinity, who take an interest in subjects relating to natural history, and by maintaining an active working organization, to enable them to enjoy those benefits which arise from unity of purpose and effort.

From the date of organization to the close of the school year, one hundred and thirty-three members were enrolled. Pupils from the public and private schools, and representing the intermediate and high school grades.

In the work of the Lyceum during the year, the subjects of Zoology and Botany were taken up, and by means of short talks, illustrated by specimens, it was attempted to present the fundamental ideas of these subjects in such a manner as to be easily understood and appreciated by the members.

Meetings were held each week, on Saturday morning and afternoon, and the attendance at these meetings—especially the morning session, was very satisfactory throughout the year.

It is especially desired in the work of the members, to awaken an interest in the study of the natural history of this locality, and to this end excursions to the country have been taken from time to time, for the purpose of collecting specimens and becoming acquainted with methods of obtaining and preserving, as well as studying them.

The first general excursion was to Batavia Junction, on the Little Miami Railroad, on May 14. About forty members par-

*Printed for information to members in advance of presentation to the Executive Board.

ticipated in this excursion and several met with fair success in securing specimens. We would take this opportunity to express our thanks to Mr. John Breen, train dispatcher of the Little Miami, for the kindness and favors extended to the Lyceum on this occasion.

Several sub-excursions were taken during the summer, for the purpose of collecting in some special class of specimens, as shells or plants.

To encourage collecting in this locality, I last spring, offered prizes to the members for the best collections made during the summer.

Collections were to be in one of three classes:—General Collections, including plants, fossils, shells, etc.; Botanical Collections, and Mineral Collections.

For each class the following prizes were offered:

First Prize.—Choice of books to value of.....	$5 00
Second Prize.—Choice of books to value of..............	3 00
Third Prize.—Choice of books to value of...............	2 00

Fourteen members entered collections in competition for the prizes.

The exhibition of these collections was given on Saturday evening, Sept. 24, at the Society rooms, at which time the prizes were awarded.

Mr. Davis L. James, Mr. Chas. Dury and Dr. Walter A. Dun, kindly consented to act as judges of the collections, and their decisions gave satisfaction to all concerned. The following awards were made:

For General Collections.

First prize, awarded to Chas. Iliff, 38 Hatch street; second, to Nelson Walker, 84 Hatch street; third, to Kuper Hood, Covington. Special mention, Gilbert G. Hunt, Hatch and Fuller streets.

For Botanical Collections.

First, to Miss Florence Wells, Mt. Auburn; second, to Miss Anna Lewis, 47 Baum street; third, to Miss Eugenia Moore, 47 Ellen street.

For Mineral Collections.

First, to Walter Crane, 157 York street; second, to Hubert Doisy, Covington.

The General Collections made by Leonard Barrett, Miss Miriam Cook, Misses Emilie and Juliet and Master Paul Esselborn, and the collection of Butterflies, by Alfred Knight, deserve mention as showing care and diligence in the work of the collectors.

The expenses of the Lyceum are paid by membership dues, which during the past year were ten cents per month from each member,

The receipts and expenditures from Jan. 8 to June 25, 1887, were as follows:

RECEIPTS.

From members in payment of dues.	$32 30

EXPENDITURES.

For Printing	$11 95
For Postage	1 48
For Specimens	11 45
For Express	1 55
For Excursion to Batavia Junction	4 00
	$30 43
Balance due Lyceum	1 87

During the year lectures were given by members of the Society as Follows:

"The Early History of the Earth," by Dr. Walter A. Dun.

"What to do in Cases of Accident," by Dr. B. Merrill Ricketts.

"Collecting and Preserving Insects," by Mr. Chas. Dury.

"Birds of Prey," by Wm. Hubbell Fisher.

The Lyceum was reorganized for 1887-88, on Sept. 10, and to date, sixty members have been enrolled.

A membership fee of one dollar for the year is required of each member. The money so collected is expended exclusively for the benefit of the members, in the purchase of material for illustrating lectures, printing and defraying the expenses of two excursions during the year.

The first of these excursions occurred on Sept. 17, to Anderson's Ferry, on C., I., C. & St. L. R. R., and we would gratefully acknowledge the kind favors granted the Lyceum, by the Passenger Agent of the road.

Thirty-five members participated in this excursion, and many secured valuable specimens of the fresh water sponges, shells and algæ.

The programme of lectures for the coming year is given below.

PROGRAMME FOR 1887-88.

1887.—Preliminary Meeting, September 10th. Excursion, September 17. Competitive Exhibitions of Collections made by Members and Awarding Prizes, September 24th. Course in Physics and Chemistry.—Lectures by Dr. W. S. Christopher and H. P. Smith, October 1st to December 17th.

1888.—Course in Human and Comparative Anatomy.—Lectures by Dr. John Wiggins, January 7th to February 11th. Course in Physiology and Hygiene.—Lectures by Dr. B. M. Ricketts, February 18th to March 24th. Course in Microscopy.—Lectures by Dr. Chas. E. Caldwell, March 31st to May 5th. Course in Zoology.—Lectures by Mr. Wm. Hubbell Fisher and Mr. Chas. Dury, May 19th to June 23d. Excursion, May 12th.

Dr. W. S. Christopher, Dr. John Wiggins, Dr. B. M. Ricketts, Dr. Chas. E. Caldwell, Mr. Wm. Hubbell Fisher and Mr. Chas. Dury have generously given their services in the Lyceum work, and it is due to them that we are enabled to begin the year with such fair promises of success.

Though the number of members enrolled this year is not so large as last, the active membership is larger and represents a higher grade of scholarship.

It is not pretended to go over a great range in any of the subjects to be treated during the year, but to present the fundamental truths of these sciences in such a manner as to interest and instruct, and above all to encourage and aid in individual work by members.

Last, but not least, among the objects we hope to attain through the Lyceum, is the benefit of the Society by bringing it and its work more directly to the notice of the public and especially to the notice of the friends of scientific education, and I feel confident that many valuable friends have already been secured through its agency.

In promoting this object, the members of the Lyceum are not asked to become agents of the society in any respect whatever. But it is hoped to make the strongest appeal in the character and

work of the organization, and by giving to each member the best and most liberal returns possible.

Acknowledgment should be made to the Commercial Gazette, Evening Post, Times-Star and Herald and Presbyter, for notices of the Lyceum, published from time to time.

I feel that the Lyceum has come to be a part of the work of the Society to which it can give its heartiest support, without compromising in the least its position as a scientific organization, and which will without doubt, be beneficial to it as a Society.

Very Respectfully,

H. P. SMITH, Custodian.

ZOOLOGICAL MISCELLANY.

Some Notes on Indiana Amphibians and Reptiles—No. 2.

By Amos W. Butler.

The Indiana Academy of Science held its meeting last May near Waveland, Montgomery County, Indiana. May 19th was spent in studying the natural history of a very interesting spot known as "Shades of Death" or "Garland Dell," and the day following a locality known as "Pine Hills." These interesting places are but a mile apart, and the rapidly-flowing Sugar Creek passes through them both. Although assured by the proprietors of "Garland Dell" that snakes were practically unknown there, a diligent search was made for them, resulting in collecting about a half bushel in the two days. The following list is given, because some of the notes add materially to our knowledge of the distribution of Indiana reptiles and amphibians. For assistance in making the collection I am indebted to Dr. P. H. Baker, of DePauw University, Greencastle; Prof. B. W. Evermann, of State Normal School, Terre Haute; Mr. C. U. Stockbarger, of Wabash College, Crawfordsville, and Mr. E. R. Quick, of Brookville.

Amphibia.

1. *Spelerpes bilineatus* (Green), Baird. Green's Triton; "Two-lined Salamander." Several specimens were taken.

2. *Spelerpes longicaudus* (Green), Baird. Long-tailed Triton; Cave Salamander. Several specimens were taken. They were more common at Pine Hills. They are of a decided lemon color, thereby differing much from the form found in the southeastern part of the State, which appoaches *S. ruber.*

3. *Hyla versicolor*, (LeC.) Common Tree Toad. But one specimen observed.

4. *Acris gryllus crepitans* (LeC.), Cope. Western Cricket Frog. Several taken.

5. *Bufo lentiginosus americanus* (LeC.), Cope. Toad. Common.

6. *Rana clamata* (Daudin). Green Frog; Spring Frog. Very common. The representative species of the streams. *R. halecina* was not observed.

7. *Rana catesbiana,* Shaw; BULL FROG.

One observed.

8. *Rana sylvatica.* LeC. WOODS FROG.

Very common. Both gray and reddish specimens were found.

REPTILIA.

9. *Ophibolus doliatus triangulus* (Boie), Cope. HOUSE SNAKE, MILK SNAKE.

One specimen noted.

10. *Eutænia proxima.* Say. LONG'S GARTER SNAKE.

The beautiful snake which I have referred to this species was found to be very common.

11. *Storeria occipitomaculata,* (Stor.) B. and G. STORER'S SNAKE.

One specimen of this snake was taken. It appears to be rather common about Crawfordsville, several specimens having been taken there last spring.

12. *Storeria dekayi,* (Holb.) B. and G. Dekay's Brown Snake. One specimen taken at Garland Dell and one at Pine Hills.

13. *Tropidonotus leberis,* (Linn.) Dek. BROWN QUEEN SNAKE; LEATHER SNAKE.

Very abundant. Sometimes two or three would be found under one stone.

14. *Tropidonotus sipedon* (Linn.) Holb. WATER SNAKE.

Not nearly so numerous as the last.

15. *Eumeces fasciatus* (Linn.) SCORPION; BLUE-TAILED LIZARD; BLUE-TAILED SKINK.

One specimen taken.

BROOKVILLE, IND., *September* 12, 1887.

MIGRATION OF NIGHT HAWKS.

Chordeiles virginianus.

On September 6th "Night Hawks" were flying from northwest to southeast by thousands. The flight began at about 4.30 P. M., and lasted until dark. There was a very strong wind blowing

from the southwest. The birds tacked across the wind in a most graceful manner. Some were so high they appeared as mere specks, while others came within shooting distance of the ground. When darkness came on they lit in the trees and on the ground, where many of them seemed to remain during the night. At daylight next morning a heavy rain fell, routing some of them from their roosting places. One that had rested in a gutter near my house was washed out by the rain and flew off in the direction in which they had been flying. Two specimens examined were full of grasshoppers.

On August 19th, 1886, there was a large flight of these birds. They came over every evening until the 23d. Specimens of that flight examined were filled with insects. One bird's stomach contained 320 insects, mostly winged ants. Fall birds of this species are very fat and seem to find abundant food.

Chas. Dury.

Avondale, *September* 12, 1887.

European Carp.

(*Cyprinus carpio.*)

As a result of planting these fish in our rivers and ponds several years ago, some large and fine specimens are being taken. I have heard of a number from the Ohio River. Mr. Geo. Richards writes me from Dunlap, near the Great Miami River, that he captured a fine mirror carp (*Cyprinus carpio specularis*) that weighed 8½ pounds, from that stream. He says it was the most powerful and beautiful fish he ever saw. The hook was baited with a piece of common mud catfish; water fifteen feet deep and mud bottom. I received a large mirror carp from Cleveland, taken in Lake Erie, a result of stocking the water at that place. At Mr. Henry Muth's extensive carp ponds, near Mt. Healthy, in this county, I captured some vere large and fine fishes, three and four years old. At times they greedily took a hook baited with worms or corn. They can be reared, fed and fattened in a pond without running water, and grow with astonishing rapidity. It is estimated that a female carp weighing five pounds contains five hundred thousand eggs. At an age of three and one-half years (under favorable conditions) the carp will attain a weight of fourteen pounds. Mr. Muth spawns his fish by putting branches of cedar and juniper into

the water on which the fish deposit the eggs. To prevent the old fish from eating up their eggs these branches are removed to smaller ponds, where they are hatched, and the great destruction of eggs and young fish by natural causes is guarded against and prevented. In addition to rearing carp, Mr. Muth also rears thousands of goldfish, of several varieties, for sale. His fish farm is a very interesting place to visit.

CHAS. DURY.

AVONDALE, *September* 12.

THE JOURNAL

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PROCEEDINGS.

BUSINESS MEETING, *October* 4, 1887.

Vice-President Fisher in the chair, 18 members present.

The minutes for the July meeting were read and approved.

Dr. A. N. Ellis and Prof. J. M. Snodgrass were elected active members.

The following named persons were proposed for membership: Active, Mrs. Pauline Esselborn; Honorary, Prof. John S. Newberry, of Columbia College, New York; Corresponding Mr. W. R. Leighton, Leavenworth, Kansas.

Mr. Karl Langenbeck was elected Secretary in place of Mr. Knight resigned.

The following short paper was read by Mr. W. H. Knight:

Gen. Thomas L. Young's White or American Elm—(Ulmus Americana, L.)—by Adolph Leue.

"This species of trees was considered by Michaux as the grandest vegetable in America. It attains a height of from 90 to 120 feet with a trunk of from 5 to 7 and even more feet in diameter. The wood, which is very tough and difficult to split, is largely used for wheel stock and saddle trees. The early settlers, however, had no use for this tree because they could not split the logs into rails, and when sawed into lumber it would spring and was prone to decay. Consequently the older trees were generally girdled and the younger ones were cut down.

Of the older specimens which were spared, one of the most remarkable that has come to my notice in this section of the State, may be seen growing on the grounds of Gen. Thomas L. Young, and shading his residence on Colerain Avenue, south of Bates Avenue, in this city.

This tree is about 75 feet high. Its trunk at 5 feet from the ground, where it is of the least dimension, measures 4 feet 7 inches in diameter; at 7 feet from the ground its diameter is 5 feet 1 inch. The tree covers an area of 5,278 square feet. At 9 feet from the ground its trunk dissolves into 5 main branches varying from 1 to 2 feet in diameter.

Our late President Garfield, who greatly admired the majestic appearance of this tree, believed it to be 150 years old; but I do not think that its age can be more than 120 years. The tree is perfectly sound and bids fair to delight the eyes of the people of Cincinnati for many years to come."

The paper elicited remarks upon the classic Elms of Boston and New Haven.

A specimen of a gelatinous mass taken from the Ohio river, shown by Mr. Geo. B. Twitchell, was pronounced to be *Microcoleus pulvinatus*, Wolle. Some discussion ensued regarding the specimen.

Mr. Wm. H. Fisher remarked on the good work of the New York Forestry Bureau, not only in bringing wood thieves to trial, but spreading an interest and care in the treatment of trees, which is very apparent in the Adirondacks, in spite of the enormous influx of tourists. The barking of trees for building shanties is much less common than formerly.

A garnet shown by Dr. Heighway attracted attention from its size and perfect crystalline form.

Mr. Davis L. James gave a short description of a gas spring near Oxford, Ohio. The source of the gas was probably an ancient forest bed in the vicinity.

Donations were announced and the society adjourned.

Donations: From Miss Florence Wells, specimen of Hepatica triloba; from Messrs. Wolf and Randolph, Philadelphia, pamphlet, "Treasures of the Forest"; from Wm. P. McDonald, portion of fossil skull of Bootherium cavifrons; from Ward A. Holden, M.D., pamphlet, On an Instrument to test Refraction, etc.; from D. G. Brinton, M. D., Philadelphia, Address before the Anthropological Section of A. A. A. S.; from Mrs. Risdon, teeth of Rock fish; from Miss Gest, miscellaneous pebbles from Lake Huron; from W. R. Leighton, Leavenworth, Kansas, specimen of Camptosorus rhizophyllus; from Prof. J. W. Hall, geode in limestone.

SCIENTIFIC MEETING, *November* 1, 1887.

President Skinner in the chair.

The reading of the minutes was dispensed with.

The resignation of Mr. S. L. Coles was received and accepted.

Mr. Fisher said that owing to his notes being as yet imperfect, his paper on the "Mice of the Adirondacks" would have to be postponed.

He then read a short note on the Canada Grouse, and the fondness of the Cross-bill for salt. He also showed cones of the white pine (*Pinus strobus*) and Hemlock, (*Abies Canadensis*) collected in the Adirondack region.

Mr. Chas. Dury read an interesting paper on the travels of Mr. Wm. Doherty, a Cincinnati boy, now collecting in Borneo. Dr. F. W. Langdon by request read an interesting paper offered the society by Dr. Felix L. Oswald, entitled, "A home study in Natural History—Free Tenants."

Dr. A. E. Heighway, Jr., exhibited specimens of Talc from Georgia. He described the method of preparing talc for use. He stated he had a box of specimens for the society, and the custodian was requested to take steps to secure the same.

Dr. Chas. Caldwell exhibited specimens of the Typhoid bacillus.

A communication from Dr. S. S. Scoville, of Lebanon, Ohio, was read.

The letter was accompanied by specimens of curiously lobed black Walnuts. The hulls being marked with ridges like those of the Butternut.

It was suggested that the specimens might be hybrids.

Dr. Norton showed some carbonaceous material resembling peat. Dr. Heighway, Jr., said a similar material is used as paint in North Carolina.

The following persons were proposed for membership:

Thorton Fitzhugh,	Miss Amelia Merrill.

Members were then elected as follows:

Active,	Mrs. Pauline Esselborn.
Corresponding,	W. R. Leighton.
Honorary,	Prof. J. S. Newberry.

Dr. Heighway, Sr., exhibited bones from gravel pits near Ludlow, Ky. Also silicified wood showing marks of Beaver teeth, and several large garnets.

Mr. Skinner stated that Dr. Dun, the former President of the society, was very ill. It had been proposed that the meeting be adjourned on this account, but in view of the fact that the Doctor had been better during the day it was decided to hold the meeting. Mr. Skinner said further that the announcement was for the information of those who were not aware of the illness of Dr. Dun.

Donations were as follows:

From D. G. Brinton, M. D., Philadelphia, pamphlet "Were the Toltecs an Historic Nationality; from Chas. Brown, M. C., pamphlets, "Use of Gold and other Metals among the ancient Inhabitants of Chiriqui," "Perforated Stones from California," "Bibliography of the Eskimo Language;" from Forum Pub. Co., "The Forum," for November 1887; from Rev. Raphael Benjamin, M. A., mounted specimen of Northern Diver; from Mr. Cox, portion of Mastodon tusk; from Robt. Clarke, Esq, specimen of water beetle; from Dr. S. S. Scoville, Walnuts, showing peculiar growth; from Dr. O. D. Norton, specimens of building stone.

SCIENTIFIC MEETING, *December* 6, 1887.

President Skinner in the chair. 20 members present.

Minutes of the preceding meeting were approved.

A communication from the New York Academy of Sciences inviting the society to join in raising the necessary funds toward erecting a monument to Audobon recommended the appointment of a committee for that purpose. On motion of Dr. Heighway, Sr., the communication was received and the appointment of a committee ordered. The chair appointed Dr. Heighway, Sr., Dr. W. S. Christopher and Davis L. James.

Mr. Geo. B. Twitchell presented a paper on the "Sponges of the Ohio River," enumerating the species observed.

Mr. Wm. Hubbell Fisher presented statistics on the decay of pines in a virgin forest of the Adirondacks, 25 miles square, lying in Herkimer, Hamilton and St. Lawrence Counties, on the Beaver River.

Mr. Fisher gave further particulars about the fondness of the American Cross-bill for salt.

Mr. Davis L. James read, by title, a paper by Prof. A. P. Morgan, "The Mycologic Flora of the Miami Valley including the Thelephorei."

Dr. A. E. Heighway, Jr., spoke of the habits of the skunk, suggesting its usefulness in gardens as an insect destroyer.

Mr. Karl Langenbeck showed a crust of Ammonium salts taken from a stove pipe where it had condensed from the imperfectly burned vapors from anthracitic coal.

Mr. Geo. B. Twitchell desired to correct his identification of the gelantinous mass shown at the October meeting. Further investigation had shown it to be a polyzoan.

Mr. J. R. Skinner related the finding of specimens of *Streptelasma cornutum* in the Cincinnati Valley, with the delicate edges perfect, showing that they must have fallen in situ, and pointing to the former existence of strata higher than our present hill tops.

On reading of the resolution of the Executive Board in regard to the death of Dr. W. A. Dun, remarks were made by Dr. Ricketts, Mr. Skinner, Dr. Benjamin and Mr. W. Hubbell Fisher.

The resolution was as follows:

"With profound grief we announce to the society the death of our late President, Dr. Walter A. Dun. In addition to the sorrow of each individual of the society for the loss of a cherished friend, we have to sustain that also of one of the most active, efficient and esteemed members and officers of the society."

"Our heartfelt sympathy is offered his family in their bereavement. The society building will be closed until Thursday morning next, in testimony of our sorrow and of our affectionate regard for his memory.

"The Secretary is requested to forward copies of this testimonial to the family of the deceased and to the press."

Upon motion of Prof. Geo. W. Harper, the following committee was appointed to prepare a memorial notice of Dr. Dun to be published in the JOURNAL.

Dr. B. M. Ricketts, Dr. Raphael Benjamin, and Dr. A. E. Heighway, Jr., with power to add to their committee, should they see fit so to do.

Notice was given that an election to fill the vacancy in the Executive Board caused by the death of Dr. Dun would be held at the next regular meeting.

Mr. Jas. A. Collins and Dr. George E. Walton were proposed for and Mr. Thornton Fitzhugh and Miss Amelia Merrill elected to active membership.

The lecture committee reported through the chairman, Mr. Davis L. James, that the course of free lectures has been arranged, and that the programme would be published in a few days.

Owing to the absence of the Custodian, Mr. Smith, the announcement of donations was postponed.

Adjourned.

Donations: Dr. A. E. Heighway, Sr., fragments of Mastodon Skeleton; from Dr. O. D. Norton, specimen of lignite; from R. M. Wall, Esq., Horse-shoe Crab; from Theo. B. Basselin, Esq., through Mr. Wm. Hubbell Fisher, "Second Annual Report of Forest Commission of New York"; from Geo. B. Twitchell, specimens of fresh water sponges; from the family of Dr. Walter A. Dun, saw of saw fish, arrow and net.

Announcement of the Lecture Committee.

The six courses of Lectures previously given by the Cincinnati Society of Natural History, were thoroughly successful in giving satisfaction to the large audiences assembled, and were also of utility from a scientific and educational point of view.

The Lecture Committee submits the following program to the public of Cincinnati, trusting and believing that the present course will not only meet with the success of the former ones, but will fully sustain the reputation already established.

Lectures will be given on Friday evenings at 8 o'clock, in the rooms of the Society, 108 Broadway.

The number of tickets of admission issued for each lecture, will be limited to the accommodation of the Hall, and may be obtained at the rooms of the Society, or from members of the Lecture Committee.

Davis L. James, *Chairman.*
Raphael Benjamin, M. A.
Geo. B. Twitchell.
Lecture Committee.

Lectures.—Season of 1888.

January 6.—"How the Chemist Works." (Illustrated by Experiments.) Mr. Chas. B. Going.

January 13.—"Modern and Orthochromatic Photography ap-

plied to Natural History." (With Lantern Pictures.) Mr. Geo. Bullock.

January 20.—"The Dermal coverings of Animals and Plants." Dr. B. Merrill Ricketts.

January 27.—"The Great Deserts of the Earth." Prof. Joseph F. James, of Miami University.

February 3.—"Volcanoes." Prof. Amos R. Wells, of Antioch College.

February 10.—"Some characteristics of Fishes." Dr. D. S. Young.

February 17.—"Reason and Instinct in Animals." Mr. Charles Dury.

February 24.—"Bacteria and Fermentation." Dr. Walter S. Christopher.

March 2.—"Races of Man." Dr. F. W. Langdon.

March 9.—"The Voices of Animals." Dr. A. B. Thrasher.

ON THE MONTICULIPOROID CORALS OF THE CINCINNATI GROUP, WITH A CRITICAL REVISION OF THE SPECIES.

By U. P. James and Joseph F. James, M. Sc.,

(Continued from Vol. X, p. 141.)

Part II.

Descriptions of Species:

Family, MONTICULIPORIDÆ, Nicholson, 1879.

Genus, Monticulipora, D'Orbigny, 1850.

Prodrome de Paleont., t. i. p. 25; Nicholson, Palæozoic Tabulate Corals, p. 269, 1879; The Genus Monticulipora, p. 30, *et seq.*, 1881; De Koninck Nouvelles Recherches sur les Animaux Fossiles du Terrain Carbonifere de la Belgique, p. 141, 1872; E. O. Ulrich, American Palæozoic Bryozoa, in Jour. Cin. Soc Nat. Hist., V., p. 232, 1882 (restricted); Dybowski, Die Chætetiden der Ostbaltischen Silur-formation, 1877 (restricted).

Nebulipora, McCoy, Silurian Radiata, in Annals of Natural History, ser. 2, vol. VI., p. 282, 1850. British Palæozoic Fossils, p. 22, 1851. E. O. Ulrich, Jour. Cin. Soc. Nat. Hist., V., p. 155, 1882.

Prasopora, Nicholson and R. Ethridge, Jr., Annals of Natural History ser. 4, vol. XX., p. 38, 1877. Nicholson, Palæozoic Tabulate Corals, p. 324, 1879. The Genus Monticulipora, p. 202, 1881. E. O. Ulrich, *loc. cit.* V., p. 153, 1882.

Heterotrypa, Nicholson, Pal. Tab. Corals, p. 293, 1879. Genus Montic., p. 103, 1881. Ulrich, *l. c.* V., p. 155, (restricted). Ibid VI., 85, 1883.

Diplotrypa, Nicholson, Pal. Tab. Cor., pp. 292 and 312, 1879. Genus Montic., p. 155, 1881. Ulrich, *l. c.* V., p. 153.

Monotrypa, Nicholson, Pal. Tab. Cor., pp. 293 and 320, 1879. Genus Montic., p. 168. Ulrich, *l.c.*, V., p. 153.

Atactopora, Ulrich, Jour. Cin. Soc. Nat. Hist., II., p. 119, 1879. Ibid, V., p. 154, 1882. Ibid, VI., p. 245, 1883.

Peronopora, Nicholson, Genus Monticulpora, p. 215, 1881. Ulrich, J. C. S. N. H., V., p. 153, 1882.

Monotrypella, Ulrich, Jour Cin. Soc. Nat. Hist., V., p. 153, 1882.

Amplexopora, Ulrich, Ibid, V., p. 154, 1882.
Batostoma, Ulrich, Ibid, V., p. 154, 1882.
Batostomella, Ulrich, Ibid, V., p. 154, 1882.
Aspidopora, Ulrich, Ibid, V., p. 155, 1882.
Petigopora, Ulrich, Ibid, V., p. 155, 1882.
Discotrypa, Ulrich, Ibid, V., p. 155, 1882.
Spatiopora, Ulrich, Ibid, V., p. 155, 1882.
Cheiloporella, Ulrich, Ibid, V., p. 157, 1882.
Ceramoporella, Ulrich, Ibid, V., p. 156, 1882.
Homotrypa, Ulrich, Ibid, V., p. 240, 1882.
Leptotrypa, Ulrich, Ibid, VI, p. 158, 1883.
Atactoporella, Ulrich, Ibid, VI., p. 247, 1883.

Corallum variable in shape, massive, ramose, laminar, frondescent, encrusting, or assuming a certain peculiar form; attached or floating free. Composed of numerous tubular corallites, the walls not amalgamated with each other, and mostly without pores, but these present in a few rare instances. Tubes mostly of two kinds, one (interstitial) smaller than the other, and differing in internal features. Interior of the tubes with few or many complete tabulæ, or diaphragms, or more or less vesicular, (in sub genus FISTULIPORA). The interstitial cells more closely tabulate than the larger ones, sometimes so numerous as to completely isolate the large tubes from one another (in sub-genus FISTULIPORA). The apertures of the cells generally straight, sometimes more or less oblique, varying in shape from circular, oval, hexagonal or polygonal, to square or rhombic. Surface often showing at intervals areas occupied by corallites larger or smaller than the average. If elevated above the surface known as "monticules," and if on, or below it, as "maculæ." Sometimes forming, (in sub-genus CONSTELLARIA), star-shaped elevations, more or less thickly scattered over the surface. Spiniform corallites more or less numerous, placed either at the angles, on the edges of the cells, or, at times, projecting into the cell cavity; sometimes, (in sub-genus DEKAYIA), projecting above the surface as conspicuous blunt spines.

It will be noticed that in the above description of the genus there is no mention of any internal features save one, the tabulæ in the tubes. These features have purposely been left out because we

regard them as of little reliability.* We have in the first part of this article quoted several passages, showing that the internal structure of the specimen is not a character to be relied upon It is a fact that in all the descriptions of species the form, and external features generally, of the corallum, are specially described. Indeed in many cases these external features are the very ones which serve to distinguish species. Not only species, but sub-genera, also. For example in CONSTELLARIA, the star shaped monticule is the main distinguishing mark. In DEKAYIA it is the conspicuous blunt spine like processes. In FISTULIPORA it is the presence of interstitial cells which completely isolate the larger tubes. All these are external features. Again in *Callopora* we read: ". . the species of *Callopora* are remarkably persistent in their internal structure, and the points mainly to be relied upon in distinguishing the species are external."† Again in speaking of the separation of two new species the same writer says: "As the differences in internal structure are so slight, the external characters, such as the form of the zoarium (corallum) and monticules, must mainly be relied upon in distinguishing the two species."‡

Similar extracts could be made from Dr. Nicholson, but these, with those previously quoted must suffice.

With these facts in mind, we have decided to make the external features the basis of our classification, beginning with the general form of the corallum, and dividing each section according to other external features.

GROUP I.—*Massive:* Free, or attached at one point or by the whole of the base: more or less spheroidal, globose or massive.

a. Surface smooth; corallum massive 1.
Corallum free; spheroidal, 2.

b. Surface not smooth; massive, with monticules, 3.
Spheroidal, nodulated, 4.

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*There can be no doubt but that such diverse forms as *M. mammulata*, *M. gracilis*, *M. o'nealli*, and many others resemble each other closely in their internal structure. The same may be said of *M. winteri*, *quadrata*, *clavacoidea*, *pavonia*, *pulchella*, *calceola*, *briarea*, *tuberculata* and others, in all of which great similarity of structure is found. This being the case it might be argued with good grounds that differences of internal structure are more of the character of *individual variation* than much more. And if this be the case, then the highly magnified sections of the interior are valueless for purposes of identification. A good figure of the natural size showing the external features, and another showing the appearance of the surface as seen under a good magnifier, would be of more value for purposes of identification, than any number of magnified figures of the interior One of us has made sections of dendroid species, which are so nearly identical in internal structure with discoid and conical species, as to make it a matter of great difficulty to see any difference between them.

With the evidence then, as presented in this paper, we believe that the external form and markings of the group of organisms under consideration are much more reliable for the determination of species than the internal structure At any rate the plan here adopted is a *practicable* one, while the other is very impracticable, if not impossible, and is not to be relied upon to any great extent.

†Ulrich in 14th Ann. Rept. Geol. and N. H. Sur. of Minn., p. 96, 1886

‡Ibid, p. 87.

1. M. UNDULATA, Nicholson. *Monticulipora* (*Monotrypa*) *undulata*, Nich., Pal. Tab. Cor., 321, 1879. Genus Montic. 170, 1881.

Chætetes undulata, Nich. Geol. Mag. Dec. ii., II., 176, 1875. Rept. on Pal. Ontario, 10, 33, 1875.

Monotrypa undulata, Ulrich. Jour. Cin. S. Nat. Hist., V., 256, 1882.

Corallum forming large, lobed or laterally indented masses, with a maximum diameter of four inches, and a height of about two inches, the upper surface nearly flat. Corallites thin walled, angular and prismatic; calices sub-equal, with occasional clusters of from six or more, forming small patches, which are faintly or not at all raised above the general surface; small coralites sometimes present at the angles of junction of the larger tubes. Tabulæ few, complete, placed at corresponding levels in contiguous tubes.

Obs. This form has as yet, we believe, been found only in the Trenton of Canada. A small, spheroidal or hemispherical form found in the Cincinnati Group, was placed by Dr. Nicholson with the *undulata*. As it differs from *undulata* so much in shape, and as it resembles the next so much, we have placed it there provisionally. Dr. Nicholson did not give this form even a varietal name. The present description is given, so that in case a form similar to it is found in this locality, as is likely to be the case, it can be recognized.

Formation and Locality. Lower Silurian, Trenton Group, Peterboro, Ontario.

2. M. TURBINATA, U. P. James.

Chætetes turbinatum, James. The Palæon., 11, 1878.

Monticulipora (*Monotrypa*) *undulata*, Nich. (The hemispherical form.) Pal. Tab. Cor., 321, 1879. Genus Montic. 170, 1881.

Chætetes subglobosus, Ulrich, Jour. Cin. S. Nat. Hist., II., 129, 1879.

Monotrypa subglobosa, Ul., Ibid, V., 256, 1882.

Corallum free, forming globular, pear-shaped or irregularly rounded masses, from one quarter of an inch to an inch or more in diameter. Surface smooth; calices polygonal or sub-circular, sub-equal, sometimes larger at the base; maculæ consisting of groups of six or more slightly larger calices scattered over, and only a little or not at all raised above the surface. A few minute tubes wedged in at the angles of junction of some of the larger tubes. Walls shown in fractured specimens to be strongly wrinkled. Tabulæ few in number. (Pl. 2, figs. 1*a*, *b*, *c*.)

Obs. This species was first briefly described and named provisionally by one of us in Sept., 1878, in *The Palæontologist* under the name of *Chætetes turbinatum* (as above.) Mr. Ulrich's name of *subglobosa* was printed in Oct., 1879. A note made and put with some specimens at the time of publication of this name was to the following effect: "Mr. Ulrich described and figured this species in Jour. Cin. Soc. Nat. Hist. for Oct., 1879, issued Feb. 13, 1880, under the name of *Chætetes subglobosus*. He was aware of my published description and name a year or more before his was in print. He talked with me about it. U. P. J." Under these circumstances we think it justifiable to claim priority for *turbinata*. The species varies in shape from pear-form to nearly globular, and can be readily recognized by its form and its smooth surface.

Formation and Locality. Lower Silurian Cincinnati Gr., Cincinnati, Batavia, O., and Covington, Ky.

3. M. FILIASA, D'Orb. 1850.

Prodrome de Paleont., p. 25.

Chætetes filiasa, Edw. and Haime. Polypiers Fossiles des Terrains Palæozoiques, p. 266, 1851. Nicholson, Palæontology of Ohio, Vol. II., 206, 1875.

Monotrypa filiasa, D'Orb. Ulrich. J. C. S. N. H., VI., 163, 1883 (with a query).

Corallum forming irregular masses, attached at the base to foreign object. Surface more or less convex, covered with more or less prominent, rounded monticules; corallites thin-walled, sub-equal. No interstitial cells.

Obs. This is an illy defined form. The only description to which we have access is that given in the Ohio Palæontology as above. It is often quite large, entirely covering the shells of species of *Ambonychia*. One of us has a specimen four and one-half inches across the longer diameter, the coral extending an inch or more beyond the edge of the shell, and showing the corallites at places on the underside. The upper surface has numerous elevations which are possibly the beginnings of branches. Still another specimen is about two and one-half inches high and about the same in diameter. This is also attached to the shell of an *Ambonychia*.

Formation and Locality. Lower Silurian, Cincinnati Gr., Cincinnati, Ohio, and other points in Cin. Gr.

4. M. IRREGULARIS, Ulrich.

Chætetes irregularis, Ulrich. Jour. Cin. Soc. Nat. Hist., Vol. II., 129, 1879.

Monotrypa irregularis, Ulrich. Jour. Cin. Soc. N. H., V. 256, 1882. Nicholson, Genus Monticu. p. 177, 1881.

Corallum small, three fourths of an inch in diameter, apparently free. Generally spheroidal, the surface covered with irregular and well marked nodules. Corallites of one kind only, thin-walled, polygonal. No monticules or groups of large or small corallites. Tabulæ almost absent, but when present developed at corresponding levels in contiguous tubes as in *M. undulata*, Nich.

Obs. This species is similar in shape to *M. turbinata*, James, but is easily separated by the nodulated surface, and much smaller corallites. One of us has a specimen with a conspicuous pointed base, and a puff-ball like form, the upper surface irregularly nodulated. Still another specimen is about one and one-quarter inches in diameter, with six conspicuous divisions above, the surface of these being entirely smooth.

Formation and Locality. Lower Silurian, Cincinnati Gr., Hamilton, Morrow, etc., Ohio.

GROUP II. *Discoid:* Free, plano-convex, concavo-convex, or conical; the upper surface bearing cell appertures, the lower covered with an epitheca.

a. Corallum concavo-convex.
  * Epitheca concentrically lined or wrinkled.
    † Cells generally similar, 5.
    † Clusters of larger cells, 6, 7, 8.
  * Epitheca with lines radiating from the centre, 9.
  * Epitheca with lines radiating from one point at the side, 10.
  * Epitheca with a groove, 11.

b. Corallum conical.
  * Edges thin.
    † Epitheca concentrically wrinkled, 12.
    † Epitheca with a groove, 11.
      § Monticules small, 13.
      § Monticules prominent, 14.

5. M. DISCOIDEA, U. P. James.

Monticulipora (*Monotrypa*) *discoidea*, James. Nicholson, Genus Montic., 193, 1881.

Chætetes discoideus, James. Cat. Foss. Cin. Gr., 1871, (Named but not figured or described.) Nicholson, Quart. Jour. Geol. Soc., XXX., 511, 1874; Pal. of Ohio, II., 206, 1875; Ann. Nat. Hist. ser. 4, XVIII., 88, 1876.

Amplexopora discoidea, Ulrich. J. C. S. N. H., V., 255-56, 1882.

Leptrotrypa discoidea, Ulrich. Ibid, VI., 158, 1883.

Corallum free, discoid, concavo, or plano-convex, sharp edged, from five to eight lines in diameter, and about one line in thickness in the centre. Under surface generally concave, covered with a thin, smooth and irregularly striated epitheca, usually with two or three marked, concentric wrinkles. Upper surface, carrying the calices, gently convex, and without any monticules. Calices polygonal, sub-equal, occasionally collected into maculæ. Walls thin. No interstitial cells. Spiniform corallites situated at the angles of junction of the cells.

Obs. This species is easily recognized by the disk-like form of the corallum, with the under surface concentrically striated, and the upper one smooth, and with polygonal calices. Prof. Nicholson, in the Ohio Palæontology, suggested that possibly this was the young of *Chætetes petropolitanus*, but has later (Genus Monticulipora, as above), considered it well defined

Formation and Locality. Lower Silurian, Cincinnati Group, Cincinnati, O. Hudson River Group at Weston, near Toronto, Canada. Also in Trenton Group, Galena Limestone and Hudson River Group, of Wisconsin (see Geol. Wis., IV., 351, 1882.)

6. M. NEWBERRYI, Nicholson.

Monticulipora (*Prasopora*) *newberryi*. Nich. Genus Montic. 212, 1881.

Chætetes newberryi, Nich. Pal. Ohio, II., 212, 1875.

Prasopora (?) *newberryi*, Nicholson. Ulrich, Jour. Cin. Soc. Nat. Hist., VI., 165. 1883.

Aspidopora newberryi, Nich. Ulrich. 14th Ann. Rept. Geol. & N. Hist. Sur. Minn., 91. 1886.

Aspidopora parasitica, Ulrich. Ibid, 90. 1886.

Prasopora contigua, Ulrich. Ibid, 87. 1886.

Corallum forming a thin, sub-circular or semi-circular expansion, occasionally seemingly parasitic, but generally free, the under surface having a thin epitheca. Upper surface smooth, but with groups of corallites larger than the average, and these at times forming low monticules. Calices polygonal, sub-quadrate, or oval,

often regularly arranged in lines. Walls thin. Interstitial tubes present in well preserved specimens, but difficult to detect on the surface. Spiniform corallites to be seen in well preserved specimens.

Obs. This species seems to have been generally free, but in the form described by Mr. Ulrich as *Aspidopora parasitica*, it seems to become occasionally parasitic. In this form, when the object to which it becomes attached is too small, the edges show a well-marked epitheca, so it may not really be parasitic even here The groups of larger calices scattered over the surface is a well marked feature

Formation and Locality: Lower Silurian, Trenton Group at Minneapolis, St. Paul and other places, Minnesota. Cincinnati Group, Cincinnati.

7. M. ELEGANS, Ulrich.

Chætetes elegans, Ul. Jour. Cin. Soc. N. Hist., II., 130. 1879.
Discotrypa elegans, Ul. Ibid, V., 257, 1882. VI., 164, 1883
Aspidopora arcolata, Ul. Ibid, VI., 164, 1883.

Corallum free, thin, circular, from three lines to one and one-half inches in diameter, and about one-fourth of a line thick; the upper side convex, the lower concave, but specimens generally flattened by pressure. Under surface with an epitheca with concentric and sometimes radiating striæ. Upper surface with low, broad monticules, the bases often nearly in contact. Calices sub-equal, oval, elliptical, hexagonal, or rhombic, those occupying the monticules often larger than those on the rest of the corallum. Interstitial cells occasionally present, occupying spaces between larger calices. Walls of corallites moderately thick. Spiniform corallites few to numerous

Obs. This species is closely allied to the preceding, into which, perhaps, it may run. It can be separated, if at all, by the low, broad monticules and the variable shape of the calices. The main difference to be noted in the form called *arcolata* is the shape of the cells; but these assume various shapes on the same corallum and so cannot serve as a means of separation.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O., and Covington, Ky.

8. M. LENS, McCoy.

Edw. and Haime. Brit. Foss. Cor., 266. 1854. (Pub. Lond. Palæontological Society).

Nebulipora lens, McCoy. Ann. and Mag. of Nat. Hist., ser. 2, VI, 283, 1850. Brit. Pal. Foss, 23, 1851.

Fistulipora lens, Whitfield. Ann. Rept. Geol. Sur. Wisconsin for 1877, p. 69. Geology of Wisc., IV., 156, 1882.

Monticulipora (*Heterotrypa*) *circularis*, U. P. James. The Palæontologist, 46, 1882. Ibid, 58, 1883.

Calloporella harrisi, Ulrich. Jour. Cin. Soc. Nat. Hist., VI., 91, 1883.

Corallum circular, concavo-convex, the concavity of the base corresponding to the convexity of the upper surface; varying in size from less than one-fourth of an inch, to an inch in diameter, and from one-half to about one line in thickness. Upper surface smooth, destitute of monticules, and with occasional groups of cells slightly larger than the average; underside lined with a very thin epitheca, occasionally worn away so as to show the bases of the corallites underneath; when present showing fine concentric lines and radiating striæ. Embedded specimens sometimes found with the underside uppermost Calices circular, or nearly so, often arranged in regular lines, with from four to twelve or more in a row. Walls of cells in well preserved specimens thin, but in worn ones thicker. In the last case a good magnifying power shows the spaces between the larger cells with many small cells or pores.

Obs. This species is well characterized by its circular form, and by the regular arrangement of the cells in curved lines. The fact is peculiar that three separate investigators in naming the fossil, should choose the same name in two cases, and a word meaning the same thing in the third instance. There can be no doubt that Prof. Whitfield's *Fistulipora lens* belongs to this species, though the two were found in localities so far apart. Nor can there be a question but that the other two, *M. circularis* and *Calloporella harrisi* are likewise synonyms of *M. lens*, McCoy.*

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*The two descriptions are given here for comparison.

M. lens, McCoy.

"Corallum forming lenticular masses, averaging 10 lines in diameter, and one and one-half lines thick in the middle, gradually thinning to the edge; base slightly concave, with small concentric wrinkles; upper surface evenly convex; clusters of larger cells rounded, flat, or slightly concave, about one line in diameter, and usually a little more than their diameter apart (averaging from 16 to 20 cells between one centre and another); smaller tubes averaging 8 in one line, larger tubes of the clusters averaging 4 or 5 in one line; two inter-diaphragmal spaces equal the diameter of the tubes; apparently 2 irregular close rows of connecting pores on each face of each tube (?)" McCoy, quoted by Ed. and H., as above.

Fistulipora lens, Whitf.

"Corallum growing in small, discoid or plano-convex, button-shaped bodies, which appear to have commenced their growth on a fragment of shell or other substance, and afterward become free; discs varying in size from $\frac{1}{4}$ or less to nearly $\frac{3}{4}$ of an inch in diameter; under surface more or less concave, not usually possessing an epitheca, but presenting a fine, radially striate surface, from the exposure of the cell tubes; cells radiating from an imaginary centre, and forming on the upper surface of the disc ex-

Formation and Locality: Lower Silurian, Hudson River Group of Wisconsin. Cincinnati Group, Clinton, Warren and Butler counties, Ohio, at Oxford, Blanchester, Westboro and other places. The British specimens from Wales.

9. M. CALYCULA, U. P. James.

Monticulipora (*Diplotrypa*) *calycula*, James. Nicholson, Genus Monti., 165, 1881.

Lichenalia (?) *calycula*, James. Cat. Foss., Cin. Gr., 1871. (Named but not figured or described.)

Chætetes (?) *calycula*, James. Cat. Foss., Cin. Gr., p. 1, 1875.

Prasopora calycula, James. Ulrich. Ibid, VI., 165, 1883.

Corallum free, thin, irregularly circular, sometimes leaf-like; from one or two lines to two inches in diameter, concavo-convex, or nearly flat, about one-quarter of a line in thickness. Upper surface generally smooth, with oval or circular calices often arranged in regular lines, four to twelve in a curved row, starting generally from the center. Under surface deeply concave, covered with a thin epitheca, with a few concentric wrinkles, and sometimes fine radiating striæ. Calices of two kinds, the larger oval, only touching each other at points, the smaller angular and variable in size, filling spaces between larger cells. In well preserved specimens walls thin, but in worn ones, thickened. Spiniform corallites numerous, situated at angles of cell walls.

Obs. This species is similar in some respects to the preceding, but it differs in this: that while in the preceding form the edge of the corallum is regular and thickened, in *calycula* it is thin and sharp, often irregular. Many specimens are found with that side which bear the apertures buried in the matrix, while the under surface is exposed. Dr. Nicholson says he has never seen any specimens entirely free; but one of us has a number of specimens showing the upper surface.

Formation and Locality: Lower Silurian Cincinnati Group, Cincinnati, O.

10. M. ECCENTRICA, U. P. James.

Monticulipora (*Heterotrypa?*) *eccentrica*, James. The Palæontologist, p. 48, 1882.

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tremely minute, rounded or polygonal apertures, with often a thin partition wall; but more frequently the wall has a thickness of nearly half the diameter of the cell, with one large intercellular pit occupying the space between the adjacent cells, and other smaller ones between the cells wherever the walls are thick enough to permit them; the walls near the angles between the cells bear small elevated points or nodes in many or most cases, as seen when looked at obliquely under a strong lens, four of the cells occupy the space of 1 mm." Whitfield, as above.

Corallum plano, or slightly concavo-convex, sub-circular, small, from one to two lines in diameter, and one-half a line or less thick. Under surface often exposed in specimens imbedded in the rock, flat or slightly concave; epitheca thin, with fine concentric lines, having a starting point near one margin. Fine lines also radiate from the eccentric starting point to the margin. Bases of corallites easily seen through the epitheca. Upper surface gently convex, smooth. Calices circular, similar in size, with a few of the central ones slightly larger than the others. Walls thin. Interstitial corallites few or numerous. (Plate 2, figs. *2a b c*.)

Obs. This species can be readily recognized by its small size, and the radiating striæ having an eccentric starting point near one edge of the corallum.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O.

11. M. FALESI, U. P. James.

Jour. Cin. Soc. Nat. Hist. VII., 138, 1884.

Corallum free, oval or round; the upper surface low and convex in the oval specimens, and steep and conical, with a small apex in the round ones; varying in size from about one-half to three-fourths of an inch in diameter, and from one-quarter to three-quarters of an inch high. Margins thin and sharp. Under surface peculiar in possessing a regularly outlined conical groove, extending nearly across the middle of the longest diameter, and with a pointed end, the concave surface of the groove covered with fine transverse striæ. Calices circular and polygonal; stellate maculæ distributed irregularly over the surface, little or not at all elevated, and sub-solid or with a larger cell in the center. Walls of cells thin; interstitial cells and spiniform corallites few.

Obs. The peculiar feature of this species is found in the conical, sharp-pointed groove which extends across the under surface, and which seems to be a constant feature. The low, oval specimens seem to be young individuals.

Formation and Locality: Lower Silurian, Cincinnati Group, Danville, Ky.

12. M. PETASIFORMIS, Nicholson.

Monticulipora (*Monotrypa*) *petasiformis*, Nich., Genus Montic., 190, 1881.

Corallum free, conical or discoidal, varying in size from one-half inch to nearly two inches in diameter, and also variable in

shape. Under surface flat or concave, covered with a concentrically striated epitheca. Corallites springing upwards, at right angles to the base, and giving rise to an expansion thin at the edges, and elevated in the centre from one-half an inch to an inch above the base; sometimes two elevations are present. Calices thin walled, polygonal, nearly equal in size. Scattered over the surface are clusters of slightly larger cells, either even with the surface or raised slightly above it. Interstitial cells very few or none.

Obs. This is one of the forms formerly classed with *M. petropolitana*, and one which would, perhaps, be best replaced there.

Var. WELCHI, U. P. James.

Monticulipora (*Monotrypa*) *welchi*, James. The Palæont., 50, 1882.

This variety has the same general mode of growth as the typical form. The monticules are much more pronounced, and the central portions are occupied by from four to ten or more small pores, the larger calices surrounding or being mingled with these. Interstitial cells are rarely found scattered among the calices covering the general surface. One peculiar feature is to be found in certain projections, either straight or branching, which spring from the upper surface of the corallum.

Formation and Locality. Lower Silurian, Cincinnati Gr., Cincinnati, O.

13. M. WHITEAVESII, Nicholson.

Monticulipora (*Diplotrypa*) *Whiteavesii*, Nich., Genus Montic., 160, 1881. (pars), Nich., Pal. Tab. Corals pl., XIII. figs 4, 4*b*.

Chœtetes petropolitanus, (pars) Nicholson, Quart. Jour. Geol. Soc., XXX., p. 510, 1875. (pars) Pal. of Ohio, II., p. 204, 1875, (pars) Geol. Mag. Dec. ii., Vol II., 175, 1875. (pars) Ann. Nat. Hist. ser. 4, XVIII., 88, 1876; Rept. Pal. of Ont. 10, 1875.

Monticulipora (*Prasopora*) *selwynii*, Nicholson, Genus Montic., 206, 1881.

Prasopora simulatrix, Ulrich. 14th Ann. Rept. G. and N. H. Sur. Minn., 85, 1886.

P. conoidea, Ul. Ibid, 87.

Diplotrypa infida, Ul. Ibid, 88.

Corallum discoid when young, hemispheric when adult, often with wide margins; varying in size from one-half inch, to one and one-quarter inches in diameter, and from two to six lines or more high. Under surface with a concentrically wrinkled epitheca, generally deeply concave, but sometimes flat. Upper surface with scattered and very slightly raised monticules, composed of corallites slightly above the average size. Corallites directed at nearly right angles to the entire basal plate, to the upper surface, and of two kinds, large and small, and both intermingled. Large tubes more or less thin-walled, angular, sub-angular, or hexagonal, sometimes in groups of four or five each. Small corallites very numerous and variable in size and form, always thin-walled and angular, filling the spaces between the larger tubes. Spiniform corallites at the angles of junction of the cells.

Obs. This species is similar in form to *M. petasiformis*, Nich., but differs in its numerous, angular interstitial cells, and the presence of monticules. The species described as new by Mr. Ulrich, as above, are the same as far as may be judged from the descriptions, and it would be a puzzling matter to say just what the distinctions between them are. *M. selwynii*, Nich., is placed here as a synonym because it is utterly impossible to distinguish it from *whiteavesi* from the external form of the corallum, the sole difference being in the interior structure. This is considered so important by Dr. Nicholson as to induce him to put the two forms in different sub-genera. Specimens identified by us as this species are much worn on the surface so the calices do not show well, but we feel reasonably sure of the identification.

Formation and Locality. Lower Silurian, Trenton Group. Peterboro, Ontario; Minneapolis, St. Paul, &c., Minnesota; Kentucky and Tennessee. Cincinnati Group, Warren and Clinton Counties, &c., Ohio.

14. M. CINCINNATIENSIS, U. P. James.

Monticulipora (*Peronopora*) *cincinnatiensis*, James. Nicholson, Genus Montic., 226, 1881.

Chætetes cincinnatiensis, James. Cat. Low. Sil. Foss., 2, 1875.

Monticulipora consimilis, Ulrich, Jour. Cin. Soc. N. Hist. V., 238, 1882.

Prasopora nodosa, Ulrich, Ibid, V. 245, 1882.

Corallum either free or attached, forming a layer a line or less thick. Under surface with a strongly wrinkled epitheca, not often

seen. Upper surface covered with numerous conical and very prominent monticules, the bases of which are close together. Calices sub-polygonal, thick walled, with a moderate number of interstitial cells. Corallites of two kinds; the larger generally oval or circular, the smaller variable in shape, but more or less angular.

Obs. This species is readily recognized by the very prominent conical monticules of the upper surface, there being no other species of the discoid group which has such prominent elevations on the surface. Of *M. consimilis* there was but a single fragmentary specimen found, and we believe ourselves justified in placing it here as a synonym. *Prasopora nodosa* is undoubtedly the same as *cincinnatiensis*, though from another horizon. Mr. Ulrich has seen fit (J. C. S. N. H. V., 239) to disregard the fact that the species under notice was named and described by one of us, and he has placed Nicholson's name after it as authority. This, either intentional or accidental, he has repeated in other species, a course which is as unjustifiable as it is unjust. It is here noticed in order that it may not mislead future students.

Formation and Locality: Lower Silurian, upper part of Trenton Group, at Nashville, Tenn. Cincinnati Group, at Cincinnati and Oxford, O.

GROUP III. *Dendroid or Ramose;* branching more or less; stems cylindrical or sub-cylindrical; base free or attached; calices covering the branches, varying in form: monticules present or absent.

I. Surface smooth.

a. calices oval or circular; all similar.
- * apertures of calices thick........................15
- * apertures oblique; lips thin 16

b. calices oval or circular; interstitial cells present.
- * apertures oblique; lips thick....................17
- * maculæ present, with larger cells than average; lips thick 18
- * larger cells separated by number of small ones...19
- * maculæ present; made of larger cells, and occupied also by minute cells.........................20
- * calices surrounded by ring-like wall 21

c. calices rhomboidal; arranged in lines.................22

d. calices irregular in form 23, 24

II. Surface with maculæ or low monticules.

a. calices polygonal or sub-polygonal.

* clusters of cells larger than average; interstitial cells few 25
* clusters of cells smaller than average; interstitial walls numerous 26
* low monticules present; no interstitial cells...27, 28

b. calices oval or circular.

* maculæ or monticles formed of smaller cells..29

III. Surface with conspicuous monticules.

a. calices of two kinds; monticules elongated or conical.

* calices large, sub-polygonal..........................30
* calices large, oval 31
* calices ovate or sub-circular..........................32

b. calices of two kinds; monticules conspicuous, arranged in alternate manner..............................33

c. calices sub-equal; monticules small, arranged in alternate manner..................................34

15. M. BRIAREA, Nicholson.

Monticulipora (*Monotrypa*) *briarea*, Nich. Genus Montic, 198, 1881.

Chætetes briareus, Nich., Pal. Ohio, II., 202, 1875.

Monotrypella briareus, Ulrich. Jour. Cin. S. Nat. H., V., 248, 256, 1882.

Corallum free, dendroid, expanding above; branches variable in number, two and one-half to four lines in diameter, cylindrical, possibly branching more than once. Surface smooth. Calices of one kind only, oval or circular. Walls of corallites thick at the surface. Interstitial tubes and spiniform corallites wanting.

Obs. This is quite a peculiar species, with an apparently free base, tapering to a point and branching in a digitate manner above. One of us has a very large specimen on a slab, some six inches long and spreading out two inches or more at the top. The ordinary specimens, however, are from one and a half to two inches long. The free, pointed base will serve to readily distinguish it from the other dendroid species.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O. Hudson River Gr., Wisconsin.

16. M. DELICATULA, Nicholson.

Chætetes delicatulus, Nich. Pal. of Ohio, II., 199, 1875.

Chætetes (?) *minutus*, U. P. James. The Palæont, p. 20, 1879.

Corallum dendroid, slender and delicate, stem simple or branched, from one fourth to one-half, and rarely two-thirds of a line in diameter; branches cylindrical, sometimes terminating in thickened, rounded extremities, and sometimes appearing to spring from a horizontal footstalk; branching dichotomously, at acute angles. Surface smooth. Calices of one kind only, oval, arranged in diagonal rows, eight in one line measured longitudinally, twelve to fourteen in one line measured diagonally; openings oblique to the surface, with lower lip thin and prominent. Interstitial tubes absent. Perfect specimens show sharp spines on the edges of the walls of the corallites.

Obs. This species is mainly distinguished by its small size, slender habit, the great obliquity of the tubes, and the thinness of the walls. Dr. Nicholson* now regards this as a Polyzoan, but as it has been described as a Monticuliporoid, we have thought it best to insert the description here.

Formation and Locality: Lower Silurian, Cincinnati Group, Oxford, and different localities in Warren and Clinton Counties, O. The form described as *minutus* in the lower beds at Cincinnati and in Clermont County.

17. M. GRACILIS, U. P. James.

Monticulipora (*Heterotrypa*) *gracilis*, James. Nich. Gen. Montic., 125, 1881.

Chætetes gracilis, James. Named but not figured or described, Cat. Foss. Cin. Gr., 1871. Nicholson, Quart. Jour. Geol. Soc., XXX., 504, 1874; Pal. of Ohio, II., 198, 1875; Ann. and Mag. Nat. Hist. ser. 4, XXVIII, 90, 1876.

Batostomella gracilis, Ulrich. Jour. Cin. S. Nat. Hist, VI., 83, 1883; 14th Ann Rept. Geol. and Nat. Hist. Surv. of Minn. 103, 1886.

Corallum dendroid, branches cylindrical or sub-cylindrical, from less than one line to three lines or more in diameter, branching at intervals. Surface smooth. Calices oval, their long axes corresponding with the long way of the branch, opening obliquely. Cell mouths greatly thickened. Interstitial tubes moderate in

*Genus Monticulipora p. 16.

number. Spiniform corallites present, but mainly to be detected by microscopic sections.

Obs. This and the next are closely allied. Dr. Nicholson considers them the same, but the smaller form, the oblique openings of the cells, the absence of maculæ, and the different horizon at which it occurs will mainly distinguish the present species from that following.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O.

18. M. MEEKI, U. P. James.

Chætetes meeki, James. Proposed in the Palæont., p. 1, 1878.

Monticulipora meeki, James. The Palæont., 35, 1881.

M. gracilis, var *meeki*, James. Nicholson, Genus Montic., 127, 1881.

Amplexopora cingulata, Ul. Jour. Cin. Soc. N. Hist., V., 254, 1882.

A. robusta, Ul., Ibid, VI., 82, 1883.

Corallum dendroid, free (?), generally branching irregularly, often but once, and having in these specimens a Y like form; the branches from less than two lines to over six lines in diameter, often hollow, compressed and filled with clay. Surface smooth, with stellate maculæ, very slightly or not at all raised above the surface. Calices sub-equal, polygonal or sub-circular, slightly larger in the maculæ. Walls thick, not spinous.

Obs. The peculiar form of the corallum seems to be a distinguishing feature in this species, at least in some localities. The lower end in perfect specimens seems to terminate in a point, often curved round. This may be only a variety of the preceding as Dr. Nicholson asserts, but its size and form will serve to distinguish it. One of us has a specimen with seven branches, which is two and one-half inches high.

Formation and Locality: Lower Silurian, Cincinnati Group, Oxford, and different localities, in Warren and Clinton Counties, Ohio.

19. M. O'NEALLI, James.

Monticulipora (*Heterotrypa*) *o'nealli*, James. Nicholson, Genus Montic., 118, 1881.

Chætetes (?) *o'nealli*, James. Cat. Foss. Cin. Gr., 2, 1875.

Chætetes sigillaroides, Nicholson. Pal. Ohio, II., 203, 1875.

Callopora sigillaroidea, Nich. Ulrich, Jour. Cin. S. Nat. Hist., V., 252.

Corallum dendroid, branching dichotomously, branches varying from less than one line to two lines in diameter. Surface smooth, calices generally oval, long axes corresponding to the long axes of the branches; of two kinds, the larger separated by a considerable number of interstitial tubes. Walls thickened at cell mouths. Operculæ often closing apertures of cells.

Obs. This species is characterized by the peculiar habit of growth, branching in a very irregular manner at almost every possible angle and anastomosing so as to form various shaped figures; by the presence of a considerable number of interstitial corallites between the larger ones, and a generally smooth surface.

Formation and Locality. Lower Silurian, Cincinnati Group, Cincinnati, O.

20. M. COMMUNIS, James.

Monticulipora (*Heterotrypa*) *o'nealli* (?) var. *communis*, James. The Palæontologist, 47, 1882.

Callopora sub-plana, Ulrich. Jour. Cin. Soc. Nat. Hist., V., 253, 1883.

Corallum dendroid, but as generally found, much broken, the cylindrical or sub-cylindrical stems from one to three lines in diameter, branching at variable distances at acute angles, but masses of considerable size—from one inch to six or eight inches or more in diameter—sometimes found, in which the stems anastomose in a very irregular manner. The surface of most specimens with maculæ or monticules, raised little or not at all above the surface, occupied by calices much larger than the average, and sometimes clusters of smaller tubules. Calices oval or subcircular, occasionally somewhat angular; interstitial corallites numerous, occasionally nearly or quite surrounding the larger cells, and of various shapes; about six calices in the space of one line in the longitudinal direction of the stem, and seven or eight transversely Cell walls thin at the surface of unworn specimens, but thickened immediately below. (Plate 2, figs. 5*a*, *b*, *e*.)

Obs. At the time of making the original description of this species, the writer believed it to be, probably, a variety of *M. o'nealli*, but on further examination of many specimens, he has come to the conclusion that it is worthy of a distinct name. Some of the main points of difference are the much larger calices in the maculæ, the greater number of small corallites between or surround-

ing the calices, and the much more robust habit of growth, generally.

Formation and Locality. Lower Silurian, Cincinnati Group, Cincinnati and vicinity.

21. M. JAMESI, Nicholson.

Monticulipora (*Heterotrypa*) *jamesi*, Nicholson. Genus Montic., 143, 1881.

Chætetes jamesi, Nich. Quart. Jour. Geol. Soc., XXX., 506, 1874; Pal. Ohio, II., 200, 1875; Ann. Nat. Hist. ser. 4, XVIII., 89, 1876.

Batostoma jamesi, Ulrich. Jour. Cin. Soc. Nat. Hist., V., 256, 1882; VI., 83, 1883.

Monticulipora (*Heterotrypa*) *implicata*, Ulrich. Nicholson, Genus Montic., 147, 1881.

Chætetes implicatus, Ul. Cat. Foss. Cin. Gr. Named, but not figured or described, p. 12, 1880.

Batostoma implicata, Nich. Ulrich, Jour. Cin. S. N. H., V., 256, 1882. VI., 83, 1883.

Corallum dendroid, branching irregularly or dichotomously, sometimes terminating in rounded ends, branches varying from two to five lines in diameter. Surface smooth or nearly so. Calices oval or rounded, sometimes indented on one or more sides, thick-walled, surrounded by a ring-like wall. Intercellular spaces solid, or with a variable number of small tubes, or with blunt spines, apparently the solid apices of the interstitial cells.

Obs. The peculiarly indented walls, the ring-like wall surrounding the apertures, and the presence of the blunt spines are the main features of this species. The species *implicata* was named by Mr. Ulrich, but was described by, and credited to him by Dr. Nicholson. Mr. Ulrich has complicated matters by placing Dr. Nicholson's name after the species instead of his own.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, Ohio.

22. M. QUADRATA, Rominger.

Monticulipora (*Monotrypa*) *quadrata*, Rom. Nicholson, Genus Montic., 179, 1881.

Chætetes quadratus, Rom. Pro. Acad. Nat. Sci. Phila., 115, 1866.

Chætetes rhombicus, Nicholson. Quar. Jour. Geol. Soc., XXX., 507, 1874. Pal. of Ohio, II., 201, 1875. Ann. Nat. Hist. ser.

4. XVIII., p. 86, 1876. (*non Dianulites rhombicus*, Dybowski, Die Chætetiden, 33, 1877).

Monotrypella quadrata, Ulrich. Jour. Cin. S. Nat. Hist., V., 248, 1882.

Monotrypella sub-quadrata, Ulrich. Ibid, V., 249, 1882.

Corallum dendroid, occasionally sub-massive, branches cylindrical, varying from two to five lines in diameter, often ending in bulbous extremities. Surface smooth or nearly so. Corallites thin-walled below, slightly thickened toward the mouths, all similar. Calices generally in parts, obliquely rhomboidal, sometimes polygonal, arranged in regular diagonal rows, the direction changing at short intervals. Lips very thin. Very few or no interstitial tubes.

Obs. This species is easily distinguished by the peculiar rhombic form of the calices, arranged in regular curved, diagonal lines, crossing each other obliquely. If the cells on the surface appear polygonal, the weathered ends of the branches invariably show the rhomboid form of the calices. The form described as *sub-quadrata*, Ulrich, is stated to have a few interstitial cells, but in all other respects it is precisely like *quadrata*. One of us has a specimen showing quite a number of interstitial cells placed in rows on one part, while the other portion shows none of these small cells. Clusters of slightly larger cells forming maculæ are occasionally present.

Formation and Location: Lower Silurian, Upper beds of Cincinnati Group. Different localities in Warren and Clinton Counties, O.

23. M. VARIANS, U. P. James. The Palæontol., 36, 1881.

Chætetes varians, U. P. James, The Palæont., 2, 1878.

Corallum variable in form, ramose, incrusting or massive. In the ramose forms branches irregular, rounded or sub-cylindrical, digitate; the massive forms irregular, contorted, flattened or lobate, four or five inches in diameter, throwing out shoots in various directions; frondose and celluliferous on both sides. Surface smooth. Calices sub circular, oval or polygonal; walls thick; interstitial cells few to numerous. (Plate 2, figs. 4*a*, *b*.)

Obs. This is an extremely variably species as far as its mode of growth is concerned. The incrusting forms seem to be the young corallums. It has been compared to *M. jamesi*, but it differs in not branching regularly, in having thinner walls and more regular calices.

Formation and Locality: Lower Silurian, Cincinnati Group, Blanchester and Clarksville, Clinton County, O.

24. M. WHITFIELDI, U. P. James.

The Palæontologist, 34, 1881.

Corallum dendroid, variable, very irregularly branched, the branches either close together or some distance apart; often rounded at the ends, sometimes swollen or flattened as if hollow; surface smooth; calices variable in size and form, polygonal, oval, circular, pentagonal, etc. Sometimes groups of calices larger than the average scattered irregularly over the surface; also groups of from six to ten small interstitial tubes; walls of corallites thin.

Obs. A characteristic feature of this species is the great variation of the calices, and the wrinkled condition of the walls, although this last is by no means confined to this species.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O.

25. M. ANDREWSII, Nicholson.

Monticulipora (*Heterotrypa*) *andrewsii*, Nich. Genus Montic., 128, 1881.

Chætetes pulchellus, Nich. (*non* Edwards & Haime). Quart. Jour. Geol. Soc. XXX., 503, 1874; Pal. Ohio II., 195, 1875.

Callopora andrewsii, Nich. Ulrich, Jour. Cin. Soc. N. Hist. V., 252, 1882.

Monotrypella æqualis, Ulrich. Ibid, V. 247, 1882.

Corallum variable, but generally dendroid, branches subcylindrical, two to six lines in diameter, flattened, expanded or inosculating. Surface with clusters of from five to seven cells slightly larger than the average, and though elevated, yet not enough to form monticules. Calices polygonal or sub-polygonal, separated by a moderate number of smaller interstitial tubes, developed principally at the angles of junction of corallites; cell walls thin in center of branches, thickened toward their mouths.

Obs. This species was first referred by Nicholson, as above, to the *M. pulchella* of Edw. and Haime, but was afterward described as distinct. It was put as *Chætetes pulchellus* in Pal. of Ohio, where the following remarks are made. "*C. pulchellus* affords an excellent instance of the enormous difficulty which the observer has to encounter when he examines an extensive *suite* of specimens of these corals, and would endeavor to separate one form from others nearly allied to it. So great is this difficulty that it must be under-

stood that no absolute assertion is made by me as to the real distinctness of the forms here described under distinct names. I have had the opportunity of examining very extensive collections of these corals, and have been enabled to separate certain examples which present characters sufficiently distinct to be recognized without difficulty by the practiced observer, but I am far from asserting that still more extensive collections might not show a graduated series, of intermediate forms uniting the apparently distinct types with one another. As regards *C. pulchellus*, at any rate, it is certain that, whilst the type specimens of the species can be recognized without the smallest difficulty, it is a matter of impossibility to determine, with the materials at present in our hands what are the true limits of the species. Thus, specimens apparently belonging to *C. pulchellus* may be picked out which approximate to *C. approximatus*, Nicholson, and which thus tend toward the type of *C. Dalei* Ed. and H., since they possess tolerably distinct surface tubercles. [*C. approximatus* is now regarded as a synonym of *dalei*, which itself is an indistinct variety of *ramosa*.] Others approach *C. fletcheri*, E. and H. [now *M. ulrichi*, Nich.] so nearly, that it becomes absolutely out of the question to draw a rigid line of demarcation between the two species, certain specimens being just as properly referred to one as to the other. In this way *C. pulchellus* is brought into direct connection with *C. gracilis*, James, though the typical examples of the two species could not be confounded with one another for a single instant. Again, the forms which I have here separated under the name of *C. sub-pulchellus* form an unmistakable transition between *C. pulchellus*, in its proper form, and *C. mammulatus*, Ed. and H., the latter belonging to the frondescent and laminar section of the genus."* These remarks indicate the close similarity of many of these species. The author may have changed his opinion in regard to some of them, but the fact itself has not been altered, that there are many difficulties in the way of separating various forms. This one is principally to be recognized by the maculæ of large cells and the small number of interstitial corallites.

Formation and Locality: Lower Silurian, Cincinnati, Group, Cincinnati, Ohio.

26. M. ULRICHI, Nicholson.

Monticulipora (*Heterotrypa*) *ulrichi*, Nich. Genus Montic., 131, 1881.

*Pal. Ohio, II., 195-96.

Chætetes fletcheri, Nich. Quart. Jour. Geol. Soc., XXX., 504, 1874; Pal. Ohio, II., 197, 1875; Ann. Nat. Hist. ser. 4, XVIII., 90, 1876.

Dekayella ulrichi, Nich. Ulrich, Jour. Cin. S. N. Hist., VI., 91, 153, 1883.

D. obscura, Ul. Ibid, VI., 89, 1883.

Corallum ramose, of cylindrical or sub-cylindrical branches, dividing at irregular intervals, and from less than two lines to about 4 lines in diameter. Surface smooth; calices sub-polygonal or rounded. Walls of corallites thickened. Interstitial corallites numerous, angular, interspersed with the ordinary corallites.

Obs. Externally this species somewhat resembles *andrewsii*, but that species is generally more robust, and has but few interstitial corallites. The surface, too, shows maculæ, with many corallites of a larger size than the average. Maculæ of *ulrichi*, if developed, are made up of rather smaller cells than the average. Some specimens show low, rounded monticules.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O.

27. M. SEPTOSA, Ulrich.

Atactopora septosa, Ul. Jour. Cin. S. N. Hist. II., 125, 1879.

Amplexopora septosa, Ul. Ibid, V., 255, 1882.

Corallum ramose; branches cylindrical or sub-cylindrical. Surface with broad, low monticules, about one line apart and occupied by groups of cells larger than the average. Calices polygonal, rather regularly arranged; walls of corallites thin; no interstitial corallites. Worn specimens show peculiar projections from the cell walls into the cell cavity.

Obs. This is rather a poorly defined species, but it will probably be distinguished by the low monticules, the absence of interstitial cells and the peculiar appearance presented by the walls of worn specimens.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O.

28. M. KENTUCKENSIS, U. P. James.

The Palæontologist, 57, 1883.

Corallum dendroid; branches cylindrical; about one line, more or less in diameter, branching dichotomously or anastomosing. Surface with low monticules irregularly distributed. Calices poly-

gonal, of various forms and variable in size. Walls comparatively thick at apertures. No interstitial pores. (Plate 2, figs. *6a*, *b*, *c*, *d*)

Formation and Locality: Lower Silurian, Cincinnati Group, Paris, Ky.

29. M. SUBPULCHELLA, Nicholson.

Monticulipora (*Heterotrypa*) *subpulchella*, Nich. Genus Montic., 134, 1881.

Chætetes subpulchella, Nich. Pal. of Ohio, II., 196, 1875.

Heterotrypa subpulchella, Nich. Ulrich, Jour. Cin. S. N. Hist. VI., 83, 1883.

Corallum dendroid; branches compressed or flattened, sometimes partially hollow. Surface nearly smooth, having somewhat stellate maculæ, scarcely elevated, and about a line apart, made up of smaller corallites than the average. Calices large and small, all with moderately thick walls, the larger surrounding the maculæ of smaller cells. Larger calices circular or polygonal; small ones sub-angular; spiniform corallites few.

Obs. This species seems to be distinguished from the other dendroid forms by the star-shaped maculæ, made up of smaller cells, thickly scattered over the surface of the flattened, sub-frondescent branches.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, O.

30. M. RAMOSA, D'Orbigny.

Prodr. de Palæont. 25, 1850; Edw. & Haime, Brit. Foss. Cor. 265, 1854.

Chætetes ramosus, Edw. & H. Pol. Foss. des Ter. Pal. 266, 1851. Nicholson, Ann. Nat. Hist. ser. 4, XVIII., 88, 1876.

Chætetes dalii, Nicholson. Quar. Jour. Geol. Soc. XXX., 501, 1874.; Pal. Ohio II., 192, 1875.

Monticulipora (*Heterotrypa*) *ramosa*, Nich. Pal. Tab. Corals, 296, 1879; Genus Montic., 110, 1881.

Callopora ramosa, D'Orb. Ulrich, Jour. Cin. S. Nat. Hist., V., 252, 1882.

Corallum dendroid, branches cylindrical or elliptical, dividing dichotomously, varying from one to three or four lines in diameter. Surface with numerous conical or slightly elongated monticules, at intervals of one-half a line to one line apart, not occupied by specially large or small corallites. Calices sub-polygonal, the walls thickened at the mouths, the larger calices completely

surrounded by smaller ones in a single row and often isolating the large ones; variable in size and shape.

Obs. A very common and variable species, the variety *a* being the more marked of the two following, while *b* may perhaps be scarcely worthy of even varietal prominence.

a var. RUGOSA, Edw. and Haime.

Nicholson, Genus Montic., 113, 1881.

Monticulipora rugosa, Ed. and H. Brit. Foss. Cor., 265, note, 1854, Dybowski, Die Chætetiden, 92, 1877.

Chætetes rugosus, Ed. and H. Pal. Foss. des Terr. Pal., 268, 1851; Nicholson, Pal. Ohio, II., 193, 1875.

Monticulipora (*Heterotrypa*) *rugosa*, Ed. and H. Nicholson, Ann. Nat. Hist. ser. 4, XVIII., 88, 1876.

Callopora ramosa, var. *rugosa*, Ulrich. Jour. Cin. S. Nat. H., V., 252, 1882.

Differs from the type in the surface having transversely elongated monticules, forming in many cases transverse ridges; these varying in length, sometimes extending round the stem, usually with sharp edges, and about one-half a line apart. Calices and interstitial tubes, as in the type

b var. DALII, Ed. and H.

Nicholson, Genus Montic., 115, 1881.

Monticulipora dalii, Edw. and Haime. Brit. Foss. Cor., 265, 1854.

Chætetes dalii, Ed. and H. Pol. Foss. des Terr. Pal., 266, 1851. Nicholson, Ohio Pal., II., 192, 1875.

Chætetes approximatus, Nicholson. Quar. Jour. Geol. Soc., XXX., 502, 1874; Pal. of Ohio, II., 193, 1875.

Differs from the type in the smaller sized monticules, and smaller number of interstitial tubes. The monticules are gently rounded, or somewhat transversely elongated. This is almost too close to the type to retain even a varietal name.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati and vicinity.

31. M. NODULOSA, Nicholson.

Monticulipora (*Heterotrypa*) *nodulosa*, Nich. Genus Montic., 116, 1881.

Chætetes (?) *nodulosus*, Nich. Quart. Jour. Geol. Soc., XXX., 506, 1874.

Chætetes nodulosus, Nich. Pal. Ohio, II., 200, 1875; Ann. and Mag, Nat. Hist. ser. 4, XVIII., 87, 1876.

Callopora nodulosa, Nich. Ulrich, Jour. Cin. S. N. Hist, V., 252, 1882; VI., 83, 1883.

Corallum minute, dendroid; stems varying from two-thirds of a line to one line in diameter, branching at intervals of two lines. Surface with numerous conical or transversely elongated monticules. Calices oval, the long axes corresponding with the long axis of the corallum, opening obliquely. Walls thickened at the surface. Interstitial corallites numerous, nearly enclosing the larger cells, angular or sub-angular.

Obs. This species is mainly distinguished by the small corallum, the closely set, sharply pointed monticules and elongated calices.

Formation and Locality; Lower Silurian, Cincinnati Group, Loveland, Ohio.

32. M. NEWPORTENSIS, Ulrich.

Atactoporella newportensis, Ul. Jour. Cin. S. N. Hist., VI., 250, 1883.

Corallum sub-ramose, lobate, robust. Surface covered with more or less prominent, rounded, often elongated monticules, the summits and slopes of these occupied by cells larger than the average. Calices sub-circular or ovate, rather regularly arranged in intersecting series, sometimes surrounded by an elevated ri n often inflected at the points occupied by the minute spiniform corallites. Interstitial cells present, but not seen readily externally.

Obs. In general aspect this closely approaches *ramosa*, but is separated from it by not having the numerous interstitial cells of that form.

Formation and Locality: Lower Silurian, Cincinnati Group, Newport, Ky.

33. M. OHIOENSIS, U. P. James.

Jour. Cin. S. N. Hist., VII., 137, 1884.

Corallum dendroid, stem and branches mostly cylindrical or sub-cylindrical, sometimes flattened, sometimes tumid; branches irregular, generally dichotomous, varying in size from one and one-half lines to six lines wide, sometimes one and one-quarter *inches* across branches. Surface with numerous conspicuous elevated monticules, arranged in alternate manner, one-half line in diameter at base and about the same distance apart. Larger calices circular or sub-polygonal; the smaller round or angular, numerous. Walls thickened at the mouths.

Obs. This species is mainly distinguished by the robust form of the corallum, together with the conspicuous monticules, both of which are marked features.

Formation and Locality: Lower Silurian, Cincinnati Group, Cincinnati, Ohio.

34. M. WORTHENI, U. P. James.

The Palæontologist, 50, 1882.

Corallum dendroid, of cylindrical or flattened stems, branching irregularly, from one to two lines in diameter. Surface with small, prominent monticules, arranged in alternating, longitudinal rows about one line apart. Apices apparently solid, the slopes occupied by cells of ordinary size or larger. Calices sub-circular or angular, margins thick. No interstitial corallites. (Plate 2, figs. 3*a*, *b*.)

Obs. This resembles somewhat *M. ramosa*, var, *dalii*, but the small, interstitial tubes are absent.

Formation and Locality: Lower Silurian, Cincinnati Group, Lynchburg, Highland Co., Ohio, and other localities in upper beds of Cincinnati Group.

[TO BE CONCLUDED.]

SOME SPONGES OF THE OHIO RIVER.

By Geo. B. Twitchell.

(Read December 6, 1887.)

Perhaps the earliest mention of fresh water sponges is that of Leonard Plukenet, in 1696. Linnæus recognized two species: *Spongia lacustris* and *S. fluviatilis*, the specific names of which are still retained, although more scientific classification has put them into different genera. These two species were founded on distinctions of external form and habitat, both very variable features in the sponges. Indeed, it is probable that the species *lacustris* prefers rapidly running water, while the specimens found in the Ohio River were in comparatively quiet water. Dr. J. H. Hunt has frequently found them in the rapids of the Miami, and Mr. Edward Potts, of Philadelphia, says that the strongest and most vigorous specimens came from running waters.

Since the time of Linnæus much has been learned about these organisms, better and more complete knowledge coming with the improvements of the microscope. Such men as Bowerbank, Grant and Carter have given the subject much thought and work. Europe, Asia, Africa and the two Americas have contributed to the number of species. Quite a number of remarkable sponges have been found in the Amazon River, while Fairmount Dam, on Schuylkill River in Philadelphia, has been considered one of the richest localities in the world for fresh-water sponges.

The fresh-water sponges, unlike the sponges of commerce, possess a skeleton whose fibre is entirely composed of siliceous spicules, bound together by a very small amount of sarcode. So that the least pressure will reduce a dry fresh-water sponge to powder. The study of the vital parts is attended with so much difficulty that it is only of late years that, with improved instruments, a proper understanding of the subject has been attained. But the spicules—upon which the classification is largely based—are easily observed, and aside from their scientific value, make beautiful objects for the microscope.

The spicules of the skeletons of the different species are all very similar, being simple needles of silica, sometimes slightly curved, more or less pointed, with the shaft either smooth or cov-

ered with spines. It is in the statoblasts that we find the greatest variety of spicules.

As early as 1766 Linnæus had observed that in the autumn certain globular bodies were developed. Sponges were then considered plants. But in 1839 Meyen, in commenting upon the *globuli*, said that they were "distinct from the sporangia of algæ, and similar to what are called the winter eggs of polyps." In keeping with this idea these bodies have since been named statoblasts, and are commonly so called, although some authors prefer the name "gemmule." Further observation developed the fact that these bodies germinate in water and reproduce the species.

In general the statoblasts may be said to be about the size of a mustard seed, varying in size and shape, but always approaching a globular form. On one side is an opening connecting with the soft matter of the interior. This soft matter is made up of a number of transparent sacs containing the germinal matter. The sacs are inclosed in a delicate membrane, which is again covered by a thicker chitinous coat. Outside of this is the wall or crust of the statoblast. This crust is composed of air cells, in some species readily distinguished, while in others the highest powers of the microscope are required to resolve them. This structure causes the statoblasts to float when detached from the sponge, and probably in some cases serves to scatter the species. Again the wall is accompanied by or charged with siliceous spicules of various forms. The statoblasts are usually to be found at the base of the sponge, frequently attached to the object upon which it is growing, but sometimes scattered through the skeleton.

In addition to the spicules of the skeleton and statoblasts, there is another kind known as "dermal" spicules. These are generally more delicate than the skeleton spicules.

In 1881 Carter published his classification, based on the form of the statoblast spicules. These characters are very constant; and as all the fresh-water sponges probably, and none of the marine come under the group Spongillina—that is, bearing reproductive organs called statoblasts—this classification, or some variation of it, seems an especially good one.

Young sponges may be found as early as June, but mature specimens need only be sought late in the summer or in autumn. They are readily detected by their bristly surface. The color and shape are generally more or less influenced by the position in which they grow. They may be found at the margins of rivers and lakes,

and sometimes in deeper water. They are not infrequently brought to the surface by dredging. The collections may be preserved in alcohol or by drying. But as the species can only be determined by examination with the microscope, it is very desirable to have preparation ready for observation. Before mounting the statoblasts or indeed any part of the sponge it is necessary that the specimen should be rendered transparent. This is most readily accomplished by soaking the part to be mounted for several hours in glacial carbolic acid, made fluid by slight heat. When sufficiently clear the specimen may be mounted in canada balsam without previously drying, as the acid and balsam mix readily. Skillful operators can prepare very interesting sections of the statoblasts, or the spicules may be entirely cleaned of all organic matter and mounted separately.

The following sponges were found in the Ohio river, during the past autumn, about twelve miles below Cincinnati:

Spongilla lacustris, Linn.—on rocks.

Spongilla fragilis, Leidy—on snags.

Meyenia leidyi, Potts—on snags and rocks.

Heteromeyenia (Sp. ?)—on gravel.

Carterius tubisperma, Mills—on gravel or rocks.

It is not likely that this exhausts the list of species to be found in our neighborhood. Indeed it is to be hoped that further observation at other points upon the Ohio, as well as on the Licking and the two Miamis may result in many interesting finds.

THE MYCOLOGIC FLORA OF THE MIAMI VALLEY, OHIO.

By A. P. Morgan.

(Read December 6th, 1887.)

Continued from Vol. X., p. 18.

Class I.—Hymenomycetes.

Order IV.—Thelephorei.

Hymenium inferior or amphigenous, coriaceous or waxy, even, rarely costate or papillose. Sporophores 4-spored, rarely 1-spored.

TABLE OF GENERA OF THELEPHOREI.

A. Growing on the ground and mostly stipitate.

1. Craterellus. Pileus entire, stipitate, fleshy or sub-membranaceous.
2. Thelephora. Pileus coriaceous, stipitate or sessile.
3. Lachnocladium. Pileus repeatedly branched, the branches filiform.

B. Sessile or resupinate on trunks and branches of trees.

4. Stereum. Pileus coriaceous, effuso-reflexed; hymenium glabrous.
5. Hymenochæte. Pileus effuso-reflexed or resupinate; hymenium setulose.
6. Corticium. Wholly resupinate; the hymenium not setulose.

C. Minute pezizoid plants, sub-sessile.

7. Cyphella. Sub-membranaceous, cup-shaped.

Genus I.—Craterellus, Fr.

Hymenium waxy-membranaceous, distinct but adnate to the hymenophore, definitely inferior, contiguous, glabrous, even or rugose; spores white.

Fungi growing on the ground, fleshy or membranaceous, furnished with an entire pileus, stipitate; allied to the Cantharelli.

a. Tubæform, pervious to the base of the stipe.

1. C. lutescens, Pers. Pileus submembranaceous, tubæform, soon pervious, undulate, flocculose, fuscous. Stipe hollow, glab-

rous, yellow. Hymenium remotely costate, at first even, then rugose with interlaced veins.

In woods; rare. Pileus 2-4 inches broad, the stipe about two inches long The hymenium is yellow, varying to reddish, orange and bluish-gray. It has a strong spirituous odor.

2. C. CORNUCOPIOIDES, Linn. Pileus submembranaceous, tubæform, pervious, scaly, sooty black. Stipe hollow, glabrous, black. Hymenium even, at length slightly wrinkled, becoming cinereous.

In woods; not common. Pileus 1-2 inches across, but sometimes reduced to little more than a tube, the whole plant 1-3 inches in height.

b. Infundibuliform, the stipe stuffed.

3. C. CANTHARELLUS, Schw. Pileus tough-fleshy, subinfundibuliform, repand and often lobed, glabrous, vitelline. Stipe stuffed, glabrous, concolorous. Hymenium even, becoming a little wrinkled, vitelline or with a darker shade.

In woods; common. Pileus 2-4 inches in breadth, the stipe an inch or more in height. The pileus in the larger specimens is quite irregular, with the margin much folded or crisped and lobed. The color of the plant varies somewhat, being paler or reddish, and sometimes with a dusky shade. *C. lateritius*, Berk. is the same thing.

Genus II—THELEPHORA, Ehrh.

Hymenium inferior or amphigenous, contiguous with the hymenophore and similar to it, even or costate, and without an intermediate stratum. Fungi coriaceous, destitute of a cuticle, exceedingly varied in shape, terrestrial.

a. Growing erect, the pileus entire or ramose-parted.

1. T. RADIATA, Holmok. Pileus soft coriaceous, infundibuliform, entire, ferruginous then brownish, subfasciate; the disk with erect scales: the margin radiate-striate. Stipe central, short. Hymenium striate, somewhat pruinose, concolorous.

In wet places in woods; rare. Nearly an inch in height, the pileus ¾ of an inch in diameter. The pileus has circular bands or zones upon its surface, and is distinctly radiate-striate with an entire margin.

2. T. TEPHROLEUCA, B. & C. Pileus soft-coriaceous, subinfundibuliform, more or less lobed, rugose, whitish. Stipe central, whitish or brownish. Hymenium striate, brownish below, pale above.

On the ground in woods; rare. About an inch in height, the pileus half an inch or so across. The pileus is not deeply lobed, the lobes are variable in width; the hymenium is brownish next the stipe, fading to whitish toward the margin.

3. T. MULTIPARTITA, Schw. Brownish-cinerous. Pileus subcoriaceous, subinfundibuliform, many times parted and divided even to the stipe; the laciniæ dilated above and more or less incised. Stipe short, glabrous. Hymenium nearly even, glabrous, brownish, sometimes paler at the margin.

On the ground in woods; not uncommon. About an inch in height; the thin flat branches dilated above obtuse and multifid, disposed in funnel-shape and more or less confluent into a multipartite pileus; the hymenium mostly even or sometimes costate-plicate beneath the laciniæ.

4. T. ANTHOCEPHALA, Bull. Subferruginous becoming brownish. Pileus soft-coriaceous, pubescent, parted into laciniæ dilated and fimbriate above and whitish at the apex, or divided into irregular ramose erect branches. Stipe equal, villous. Hymenium even.

On the ground in woods; rare. An inch or more in height; stipe villous or tomentose, dividing above into several branches, which again are multifid with white apices.

5. T. PALMATA, Scop. Brownish-purple, pubescent, fetid. Pileus soft-coriaceous, very much branched; the branches palmate, flattened, sub-fastigiate, fimbriate and whitish at the apex. Stipe short, simple. Hymenium even.

On the ground in woods; common. 1–2 inches in height, often divided nearly to the base; the branches numerous, dilated and cuneiform at the apex. Readily distinguished when fresh and growing by the very disagreeable odor which it soon gives out after being gathered. The spores are irregular and spinulose, .008.–010 mm. in diameter.

6. T. PTERULOIDES, B. & C. Gregarious, bright ochraceous. Pileus repeatedly branched; the branches smooth, more or less flattened, acute and paler at the apex. Stipes variable in length, often several crowded together. Hymenium waxy, even.

On the ground in woods; rare. 1–2 inches high; divided and sub-divided into many branches; these covered by the smooth waxy hymenium.

7. T. FILAMENTOSA, B. & C. Cæspitose, crowded, pallid. Pilei divided into numerous smooth filiform branches, somewhat

flattened and fimbriate at the apex. Stipes crowded, short. Hymenium even.

On the ground in woods; rare. An inch or two in height. Consisting of several or many stems, closely crowded together, and arising out of a common mycelium, which immediately divide and sub-divide into innumerable thread-shaped branches.

8. T. SCHWEINITZII, Peck. Cæspitose, white or pallid. Pilei soft-coriaceous, much branched; the branches flattened, furrowed and somewhat dilated at the apex. Stipes variable in length, often connate or fused together into a solid base. Hymenium even, becoming darker colored.

On the ground in woods; very common. The pilei sometimes growing separately an inch or two in height, but usually growing together in tufts or sometimes fused into large masses 4-6 inches or more in extent. This is *T. pallida*, Schw. N. A. Fungi, No. 619.

b. Pileate, dimidiate, horizontal, sub sessile or effuso-reflexed.

9. T. ALBIDO-BRUNNEA, Schw. Spongy-corky, widely effused. Pilei at length narrowly reflexed, becoming sub-stipitate, sub-tomentose, brown. Hymenium nearly even, white.

Growing about the base of dead shrubs; not common. Long and broadly confluent, mostly resupinate; the distinct pilei rarely exceeding half an inch in length, irregularly subimbricate.

10. T. MICHENERI, B. & C. Pilei soft-coriaceous, umber, spongy-tomentose, convex, often laterally confluent. Hymenium even, bright ochraceous.

Growing on the ground and upon sticks and stones; rare. Consisting of a number of orbicular laterally confluent individuals an inch or so in length, each attached by a central point or ascending and incrusting the bases of dead shrubs and more or less effuso-reflexed. Thinner and more fragile than the preceding species.

11. T. CUTICULARIS, Berk. Pileus soft-coriaceous, purplish brown, sub-tomentose, imbricated and laterally confluent. Hymenium nearly even, pulverulent.

On the ground attached to wood, twigs, etc.; rare. Pilei $\frac{3}{4}$ of an inch long, uneven, rugged, brown inclining to purple, with a pale margin; surface soft, clothed with matted down, zoneless; odor strong and unpleasant.

c. Resupinate, usually incrusting other substances, the form therefore variable.

12. T. CRISTATA, Pers. Incrusting, rather tough, pallid, passing into ascending branchlets or lacidiæ, the apices subulate or

fimbriate. Hymenium on the even spots and sides of the branches, papillose.

Growing on mosses, grasses, etc., and running over leaves. There is no constant form; it is to be recognized by its whitish color and the awl-shaped or fringed branches and lobes.

13. T. SPICULOSA, Fr. Effused, byssine then fleshy, incrusting, brownish-purple; the border spiculose-branched; the apices penicillate, whitish.

Ascending the stems of herbs, in humid places; rare. Of a brownish color, effused, throwing out here and there radiating subulate spicules.

14. T. SEBACEA, Pers. Effused, fleshy-waxy, hardening, incrusting, tuberculose or stalactitious, whitish, with a similar border. Hymenium collapsing, flocculose-pruinose.

Incrusting various substances; common. Various in form, white, the border not fringed or penicillate.

GENUS III.—LACHNOCLADIUM, Lev.

Pileus coriaceous, tough, repeatedly branched; the branches slender or filiform, tomentose. Hymenium amphigenous.

Fungi slender and much branched, epixylous or terrestrial.

1. L. SEMIVESTITUM, B. & C. Coriaceous, pale or sordid brown, tomentose. Pileus much branched from a slender stipe of variable length, expanded at the angles; the branches filiform, straight, somewhat fasciculate, glabrous at the tips and paler in color.

On rotten leaves and sticks in the ground; rare. Pileus 1-2½ inches in height, more or less flattened or expanded at the points of branching, the branches straight and slender, pubescent or finely tomentose, glabrate with age.

2. L. MICHENERI, B. & C. Coriaceous, pale brown, densely tomentose. Pileus arising from a dense tomentum, repeatedly irregularly forked and branched; the branches very slender and flexuous, with paler tips.

On old leaves and sticks; common. Pileus ½-1 inch in length, the branches very delicate, filiform and flexuous. The tomentum at the base is sometimes an "orbicular villous patch," sometimes an effused patch of mycelium of considerable extent, out of which arise several stems; it is often distributed in patches over the stem and branches even to the extremities. I think *L. subsimile*, Berk., can hardly be separated from this species.

3. L. MERISMATOIDES, Schw. Subcartilaginous, pale yellowish, minutely tomentose. Pileus very much branched from a short stipe; the branches numerous, straight, slender, dilated at the apex and somewhat fimbriate.

On the ground in woods; rare. Pileus 1–2 inches in height, the stipe branched from near the base; the branches long, slender, fastigiate, soon flattened or angular and dilated at the apex. Where the pale yellowish tomentum disappears it leaves naked the reddish-brown subcartilaginous substance beneath. This is Schweinitz's *Clavaria merismatoides*, N. A. Fungi, No. 1044.

Genus IV.—STEREUM, Pers.

Hymenium definitely inferior, even, glabrous, separated from the cuticle of the pileus by an intermediate fibrillose stratum.

Fungi lignatile coriaceous or woody, subperennial, subzonate, entire and of definite shape.

I. APUS. Pileus sessile, at first resupinate, afterward commonly pileate-reflexed and adnate behind.

We have but this section.

a. Pileus coriaceous, flexible.

1. S. RUGOSIUSCULUM, B. & C. Soft-coriaceous. Pileus effuso-reflexed, becoming subreniform with a narrow base, glabrate, finely wrinkled, brownish; the margin paler and velvety. Hymenium even, dark brown; spores brown, subglobose, echinulate .010–.012 mm. in diameter.

On old trunks; rare. Pileus 1–2 inches in breadth, projecting ¾ of an inch. The dark pileus is soft, smooth and pliant when fresh, contracting somewhat and becoming finely wrinkled when dry; the growing margin is pale and velvety-tomentose; the tomentum disappears on the older portions of the surface. It is possible this is the No. 638, *Thelephora atrata*, Sw. of Schweinitz's N. A. Fungi.

2. S. VERSICOLOR, Swartz. Coriaceous-membranaceous, thin. Pileus effuso-reflexed, becoming free, expanded, sessile with a narrow base, villous-tomentose, with numerous narrow concentric zones, variously colored; margin acute, entire or variously lobed and incised. Hymenium glabrous, even, pallid or pale yellowish.

On fallen trunks and branches of every kind of wood; very common. Pileus usually 2–3 inches in length and breadth, fan-shaped or somewhat reniform, subimbricate and often laterally connate. The colors are gray and ochraceous, varying to ferrugin-

ous and brownish. The tomentum sometimes disappears on the margin and in concentric bands on the surface; specimens ornamented by these concentric brown zones are the var. *fasciatum*, Schw. The hymenium at times has a fleshy tinge, at others it acquires a smoky or brownish hue. It is quite likely some of the forms here included may be referred to *S. lobatum*, Kunz., and some perhaps to other species.

3. S. PURPUREUM, Pers. Soft-coriaceous. Pileus effuso-reflexed, subimbricate, zonate, villous-tomentose, pallid or whitish. Hymenium naked, even, glabrous, purplish.

On old trunks of black cherry, etc.; not uncommon. Pileus projecting half an inch or more, usually much effused and densely imbricated, when dry becoming rigid, pallid or yellowish, with sometimes a black zone near the margin. Hymenium purple or lilac, changing to cinereous or sometimes to brownish.

4. S. SPADICEUM, Pers. Coriaceous. Pileus effuso-reflexed, villous, subferruginous; the margin rather obtuse, white. Hymenium even, glabrous, becoming brownish, reddish if rubbed when fresh and growing.

On old stumps and trunks; common. Pileus nearly an inch in length and breadth, mostly imbricate and confluent. The pileus is without distinct zones, the hymenium gradually acquires a smoky tint. We seem to have nearly the typical plant of this species.

5. S. HIRSUTUM, Willd. Coriaceous, rigid. Pileus effused and reflexed, strigose hirsute, subzonate, becoming pallid; the margin rather obtuse, yellow. Hymenium even, glabrous, naked, yellowish or variously colored.

On trunks and branches; common. Pileus about half an inch in length and breadth, confluent and subimbricate, but often sessile and fan-shaped with a narrow base; both pileus and hymenium are at first pale yellowish; the hairy covering of the surface is arranged in faint concolorous zones. This is probably *Thelephora ramealis*, Schw., and perhaps also *Stereum molle*, Lev.

6. S. RADIANS, Fr. Coriaceous, rigid. Pileus effused and reflexed, radiate-virgate with innate fibres, pallid with bay zones, glabrate, shining. Hymenium even, glabrous pallid.

On trunks and branches; common. Pileus half an inch or more in length and breadth, effused and confluent, but often sessile with a narrow base and fan-shaped or reniform. Its peculiar marks are the innate fibrils radiating from the base and the crowded nar-

row zones of the surface. *Stereum complicatum*, Fr. seems to me a name applied to crisped and folded forms of both this and the preceding species.

7. S. OCHRACEOFLAVUM, Schw. Coriaceous-membranaceous, thin. Pileus effused and reflexed, strigose-hispid, white or pale yellow. Hymenium even, glabrous, pale yellow.

Attached to the underside of the smaller branches. Pileus reflexed scarcely more than ¼ of an inch, effused and more or less confluent, scarcely zonate, often attached by the back and hanging free all around like a little cup or shield. Remarkable for the long hairs that invest the pileus. Specimens I have from the East are white as Schweinitz states, but those I have found in this region are pale yellow or ochraceous.

8. S. SERICEUM, Schw. Coriaceous-membranaceous, thin. Pileus effused and reflexed, silky-striate, subzonate, shining, pale alutaceous. Hymenium even, pallid.

Attached to the lower side of branchlets and twigs; not common. Pileus nearly half an inch in length and breadth, but commonly extensively effused and more or less confluent below or sometimes attached by a point and free all around. The surface presents a silky luster with faint zones; the striate appearance is caused by innate radiating fibrils. It is very distinct from *S. radians*. It is *Thelephora striata*, Fr. of the Elenchus, but not *Stereum striatum*, Fr. of the Hym. Eur.

9. S. BICOLOR, Pers. Submembranaceous, soft. Pileus conchate-reflexed, azonate, villous becoming glabrous, dark brown. Hymenium thin, glabrous, white.

On old stumps and trunks; not rare. Pileus 1-2 inches in length and breadth, subimbricate, confluent at the base. Readily distinguished by the brown upper surface and the white hymenium.

10. S. ALBOBADIUM, Schw. At first resupinate, bright brown with a white border; soon confluent and effused with a narrow submembranaceous margin; the margin undulate or subpileate, thin, subzonate, brown. Hymenium bay brown, somewhat velvety.

On the lower side of branches; very common. It begins its growth with a number of orbicular brown spots having a white border, these enlarge and become confluent forming one resupinate specimen effused for several inches; then occasionally a narrow subpileate margin is turned back on one or both sides, this margin is very narrow scarcely ever reaching ¼ of an inch in breadth. The

young growing hymenium is velvety with a minute pubescence, but it is not setulose; it becomes smoother and paler with age. It is *Thelephora albomarginata*, Berk. of Lea's Catalogue.

11. S. DISCIFORME, D C. Subcoriaceous, white. Pileus resupinate, determinate, disciform; the border thin, free, naked, marginate. Hymenium uneven, velvety.

On elm branches; rare. Forming round irregular white disks scarcely half an inch in diameter, with the margin free and raised up all around. The hymenium at first has a soft fine pubescence.

b. Pileus corky or woody, rigid.

12. S. FRUSTULOSUM, Pers. Woody, resupinate, tuberculose, crowded and as if confluent, then appearing broken into small pieces; the border absolutely marginate; around the edge and underneath dark brown or blackish. Hymenium convex, cinnamon becoming pallid, pruinose.

On very hard oak wood; common and abundant. The perfect hymenium facing the earth, at first pruinose, then pulverulent with the cinnamon spores; the part turned toward the light is sterile, pale and smooth. The apparent frustules are irregular in shape and of all sizes from half an inch in extent to minute fragments. They spead over the cut surfaces and sawed ends ot the hardest and driest White Oak logs.

13. S. SUBPILEATUM, B. & C. Corky, rigid. Pileus effuso-reflexed, zonate with concentric furrows, tanny changing to brown, tomentose; the margin undulate, obtuse. Hymenium even, pallid or whitish.

On old trunks of oak; common. Pileus 1-3 inches in breadth and projecting half an inch or more, but often effused and confluent to the extent of several feet. The large effused specimens are attached to the substratum by rough knobs and projecting points on the underside. This is a larger and finer species every way than *S rugosum*, Pers , to which it was first referred.

14. S. CANDIDUM, Schw. Resupinate, rigid, thick, irregular in outline, submarginate; the margin and underside brownish. Hymenium uneven, subpulverulent, white.

On the bark of living trees, in winter; common. Half an inch more or less in breadth. It forms small irregular white patches upon the outer surface of the bark. There is scarcely any margin. It is *Thelephora candidissima*, Schw. N. A. Fungi, No.

663. We have retained the name given in the Elenchus of Fries I., p. 189, which we suppose to be the original one in Syn. Car., No. 1061.

GENUS V.—HYMENOCHÆTE, Lev.

Coriaceous, dry. Hymenium even, beset with minute rigid setæ.

The hymenium with a common lens is velvety or pubescent, but with a moderate magnifying power of the compound microscope, the minute usually colored bristles are brought out distinctly to view.

I. APUS. *Pileus effuso-reflexed.*

1. H. RUBIGINOSA, Schrad. Coriaceous-rigid. Pileus effuso-reflexed, subfasciate, velvety, reddish; afterward becoming glabrous and brown; the intermediate stratum tawny-ferruginous, Hymenium ferruginous, velvety with minute bristles.

On hard wood of oak, beech, etc.; common. Pileus 1-2 inches in breadth and projecting ½ to ¾ of an inch. The single pilei are often shell-form but frequently many are confluent and imbricate. It is thin rigid and brittle.

2. H. CINERASCENS, Schw. Coriaceous. Pileus effuso-reflexed, strigose-hirsute, subzonate, whitish or cinereous. Hymenium cinereous, sometimes with a smoky or purplish tinge, becoming pallid or whitish, velvety with minute pellucid bristles.

On trunks of Mulberry and Elm; not uncommon. Often occurring as small resupinate patches with a narrow reflexed margin, but sometimes extensively effused for several feet with pilei re-reflexed half an inch or more. It is sometimes found with pale yellowish zones. The delicate pellucid bristles appear to be true setae and not metuloids of Dr. Cooke's genus *Peniophora*.

3. H. CURTISII, Berk. Coriaceous, thin. Pileus effused and narrowly reflexed, pallid, glabrate; the margin ferruginous. Hymenium papillate, rugose, becoming rimose, ferruginous, the minute bristles few and scattered.

On branches and twigs of Oak; common. Appearing first as small orbicular peltate patches with a paler subbyssoid margin, these then become confluent and effused sometimes for several feet in length, with a very narrow reflexed margin on either edge. The growing specimens are a bright ferruginous, becoming dull with age.

II. Resupinati. *Wholly resupinate.*

4. H. umbrina, B. &. C. Coriaceous, resupinate, adnate; the margin free and flexuous, but scarcely reflexed. Hymenium dark umber with a paler border, thickly beset with minute bristles.

On rotten wood and bark; rare. Effused irregularly for an inch or so, of a spongy texture, and somewhat separable from the substratum.

5. H. insularis, Berk. Coriaceous, resupinate, closely adnate, with a narrow white byssine border. Hymenium reddish-brown, thickly clothed with minute bristles.

On branches of sugar maple; common. At first in small circular patches with an elegant white-fringed margin; these at length become confluent and effused for several inches. A very different thing from *Stereum albobadium* which though velvety exhibits no setulæ.

6. H. purpurea, Cooke and Morgan. Coriaceous-spongy, resupinate, closely adnate, with a byssine border. Hymenium purple, fading to pale brownish, velvety with minute bristles.

On bark of hickory; not rare. Irregularly effused for several inches, of a spongy texture, bright purple with a paler margin; the bright color soon fades to a pale or dull brownish or alutaceous.

7. H. corrugata, Fr. Subeffused, closely adnate, soon grumous, pale cinnamon. Hymenium covered with ferruginous bristles, when dry very much cracked.

On branches of sugar maple, beech, etc.; common. Effused for many inches or even for several feet, forming a very thin closely adnate pale brown stratum.

8. H. spreta, Peck. Effused, thick, adnate, ferruginous. Hymenium somewhat uneven, beset with rather long slender setæ, at length cracking into frustulate areolæ.

On old wood; rare. Effused for several inches and much resembling the preceding species, but of a brighter color, thicker substance and with more delicate setæ.

Genus VI.—Corticium, Fr.

Hymenium amphigenous, even or tuberculose, arising immediately out of the mycelium and without an intermediate stratum.

In the typical species the hymenium is fertile and swelling when wet, soft-fleshy, contracted by dryness and thence commonly

rimose-parted or if entire soluble. Fungi resupinate, lignatile, often sterile.

I. LOMATIA. Resupinate, but the border free, determinate, marginate, commonly from cupular expanded.

1. C. AMORPHUM, Pers. Waxy-pliant, subcoriaceous, cup-shaped then explanate, confluent, marginate, externally white-tomentose. Hymenium even, contiguous, becoming pallid; spores obliquely elliptic, apiculate, .025 x .017 mm.

On the bark of living trees of *Ostrya Virginica*; common. At first looking like a small Peziza from an eighth to a quarter of an inch in diameter, but at length irregularly confluent, sometimes to the extent of an inch or two, always preserving however the free border which is rolled inward when dry. It is *C. Oakesii*, B. & C.

II., HIMANTIA. Resupinate, effused, immarginate; the border and underside byssine-fibrillose or strigose-hairy.

Often sterile, then fibrillose; in its perfect state, the hymenium soft-waxy.

2. C. LACTEUM, Fr. Effused, membranaceous, milk-white; the border and underside loosely fibrillose. Hymenium waxy, of a deeper color, by dryness rimose-parted.

Upon wood and bark; common. Effused for several inches. Not often perfect.

3. C. AUBERIANUM, Mont. Effused, adnate, very thin, submembranaceous, snow-white, the border persistently floccose. Hymenium becoming pallid, pubescent with minute brown bristles.

On hickory bark. "Ohio, Lea." Berkeley, in Notices, No. 252. At first orbicular, the whole floccose-mealy, at length extensively effused and confluent. This must be a curious thing. I have never met with it.

4. C. RADIOSUM, Fr. Subrotund, membranaceous, adnate, underneath appressed fibrillose; the border fringed with white fibrile. Hymenium even, glabrous, alutaceous, contiguous.

On rotten wood; common. Several inches in extent.

5. C. FILAMENTOSUM, B. & C. Effused, membranaceous; border and underside soft-tomentose, fibrillose, pallid. Hymenium pulverulent, ochraceous or somewhat olivaceous.

On old wood and bark of elm. Subiculum consisting of soft tomentose threads, on which the ochraceous or olivaceous pulverulent hymenium forms a thin stratum.

6. C. OLIVARCENS, B. & C. Effused, membranaceous; the border and underside white-fibrillose. Hymenium yellow-olivaceous, pulverulent.

On old wood of elm. Subiculum consisting of white threads, which send out delicate filaments over the wood.

7. C. ALBIDO-CARNEUM, Schw. Effused, somewhat waxy, adnate; the border and underside byssinc-fibrillose, white. Hymenium flesh-colored, pruinose, by dryness rimose.

On the smooth bark of branches of hickory. Long, confluent, but rather narrow; flesh-color in the center with an elegant fibrillose border.

8. C. CÆRULEUM, Schrad. Subrotund, then effused, adnate, at first tomentose, bright blue; the border byssine, blue changing to whitish. Hymenium soft, waxy, papillose, setulose then glabrate.

On branches of beech. Effused for several inches.

III. LEIOSTROMA. Agglutinate, and without a strigose or fibrillose border; for the mycelium passes at once into the hymenium which is closely attached to the substratum.

9. C. CALCEUM, Pers. Effused, agglutinate, waxy, very smooth, white; the border similar. Hymeninm even, glabrous, when dry rimose and rigid.

Upon dry wood. Varying greatly in form; the color also varies to clay-color and brownish. The hymenium is somewhat broken up into small pieces.

10. C. PUBERUM, Fr. Widely effused, waxy, closely adnate, indeterminate, white or argillaceous. Hymenium even, velvety, with short bristles, by dryness rimose.

Upon old wood. Very much like the preceding species, but differing in the velvety-setulose hymenium.

11. C. OCHRACEUM, Fr. Widely effused, agglutinate, soft-waxy, glabrate; the border white, somewhat radiating, soon vanishing. Hymenium pallid, then ochraceous, sprinkled with golden-glittering atoms, at length naked, papillose or tuberculose, collapsed and rimose.

Upon old wood. Effused for several inches.

12. C. SUBGIGANTEUM, Berk. Widely effused, rigid, cream-colored, brownish toward the margin. Hymenium velvety then glabrous.

On bark of sugar-maple. At first cream-colored, then acquiring a brownish tint epecially toward the margin, velvety in the younger part, smooth in the older.

13. C. PORTENTOSUM, B. & C. Widely effused, soft, thick, spongy, whitish-ochre, white within. Hymenium tuberculose, glabrous.

On very decayed wood. Forming a thick mass, spreading widely; the substance soft, white and spongy.

14. C. CINEREUM, Fr. Waxy, becoming rigid, confluent, agglutinate, lurid; the border similar. Hymenium sprinkled with a very thin cinerous pruina.

On bark or wood of hickory, beech, etc.; common.

15. C. INCARNATUM, Fr. Waxy, becoming rigid, agglutinate, indeterminate, the border radiating. Hymenium persistently bright colored, sprinkled with a very thin flesh colored pruina.

Upon bark and wood; common. The hymenium is bright red, orange, etc., retaining the color quite persistently.

16. C. CONFLUENS, Fr. Submembranaceous, indeterminate, agglutinate; the border radiate. Hymenium even, naked, hyaline, white when dry.

On bark of Acer, Vitis, etc. In small patches and widely effused; the border adnate, exceedingly delicate.

17. C. COMEDENS, Nees. Effused, innate, growing beneath the epidermis and throwing it off; flesh-colored, becoming pallid. Hymenium even, glabrous, when dry rimose.

On dry branches of Ostrya; distinguished by its peculiar way of growing upon the bark beneath the epidermis.

Sui genus. HYPOCHNUS. Corticia floccose-collapsing or furnished with a tomentose, subpulverulent hymenium.

18. C. MOLLE, Fr. Subrotund, floccose-fleshy, loosely interwoven, soft, glabrous, pallid, reddish-spotted; the underside villous, the border naked. Papilæ rather large, unequal.

On rotten wood. Hymenium loosely fibrillose and the surface not waxy.

GENUS VII.—CYPHELLA, Fr.

Fungi submembranaceous, cup-shaped, adnate behind, commonly stipitate-porrect, pendulous. Hymenium definitely inferior, similar, even or at length slightly wrinkled.

A genus formerly confused with the Pezizas, but different from them altogether, first in the lack of a heterogeneous disk, secondly in the absence of asci.

1. C. GRISEOPALLIDA, Weinm. Submembranaceous, globose then campanulate, sessile, pale gray, externally floccose. Hymenium even, glabrous.

On sticks, leaves and dead stems of herbs; not uncommon. About a line in diameter.

2. C. GALEATA, Schum. Soft-membranaceous, nearly sessile, obversely cup-shaped, then dimidiate, helmet-shaped, even, whitish; the margin entire. Hymenium finally rufescent, slightly wrinkled.

Upon mosses; not common. Two lines or more in diameter; gray when wet, snow-white when dry, finally becoming reddish-brown.

3. C. PEZIZOIDES, Zopf. Membranaceous, nearly sessile, globose then cup-shaped, clothed externally with long erect white hairs. Hymenium even brownish; spores obovate, .012-.013 mm. in length.

On old herbaceous stems; not common. Cupule pezizoid, scarcely pedicellate, about half a line in diameter. The long hairs are erect and connivent over the hymenium; they are hyaline and incrusted with crystals of calcium oxalate.

THE AMERICAN CROSS-BILL, *Loxia* (*L.*) *curvirostra minor;* (*Brehm.*) AS TO SOME OF ITS HABITS AND ITS FONDNESS FOR SALT.

By William Hubbell Fisher.

Read November 1 and December 6, 1887.

During my stay in the Adirondacks, I was much interested in the American Cross-bill, *Loxia* (*L.*) *curvirostra minor*, (*Brehm*). One of the most marked and interesting characteristics of this bird is its fondness for living in the close neighborhood of human abodes, and its boldness in the presence of man. As I observed them during the latter part of August and the first part of September of this year (1887), at Dunbar's grounds, Stillwater, on Beaver River, in Township number five of Brown's Tract, Lewis County, New York, these birds reminded me of the European sparrow, in the numbers in which they flocked around the hotel, and around the empty cottages in front of the hotel. With the rising sun they would begin their "cheep," "cheep." They would fly in a flock to a small tree about eight feet high, near the kitchen, and in such numbers as literally to fill the branches. Anon, you would see a whole row of them on a fence between the hotel and the side cabin, and while sitting there they would allow you, in passing, to approach so near that one was tempted to touch them with the hand. At another time you would see a garbage pile covered with them. They enjoyed sitting on a peak or ridge-pole of a cottage where the roof on each side slanted up to a meeting line. A favorite place for some of them was the slender flag-pole; one would sit on the top, while others seemed to enjoy hanging to the sides of the pole and looking around at the world beneath.

From Dunbar's three of us made an excursion northward past the Kettle-hole, near which the sheriff of Lewis County was so badly frozen last spring, while assisting to stock one of the lakes with fish, then past Slim Pond, thence to Raven Lake, where we were hospitably entertained at the camp of Rufus J. Richardson, by the latter and his pleasant, agreeable family. I had not been seated in their camp more than ten minutes before a couple of birds audaciously swept down and confronted us—cross-bills again.

Near Beaver Lake, Township No. 4, as we were approaching Fenton's hotel on the customary vehicle, denominated a buck-board, just above our heads on a tree was a male cross-bill, his red breast standing out in fine contrast to the green leaves about him.

In a previous article, I have alluded to the manifest fondness of these birds for salt, and mentioned how, at Otter Lake Tannery, they would gather in flocks to eat the refuse salt thrown out of the salt-pork barrels.

I cannot close this article without mentioning certain interesting facts in point given me recently by Mr. Romeyn B. Hough, of Lowville, Lewis County, New York. He writes as follows:

* * * "The ice-cream freezer to which you refer I saw at the Forge House (Moose River) a few years ago. Its staves were made of oak, about one-half or five-eighths of an inch thick, as I remember it, and were naturally permeated with salt. It had been standing during the winter previous in a place where the cross-bills would get at it, and judging from the looks of it, there must have been a general understanding among them that it was a salt-lick for all. I was told that they would constantly visit it during the winter in flocks for the salt which they derived from its substance. They had nibbled and gnawed away at the edge of the freezer until they had eaten it down in one place five-eighths of an inch, as nearly as I could judge without measurement. The wood, probably, in that place was not quite so hard as elsewhere, but the whole rim showed their gnawing more or less, excepting possibly in one or two places, where knots occurred, which were altogether too hard for their beaks. The work looked quite like that done by mice, only, of course, you could not see teeth marks.

"Another instance illustrative of the craving of cross-bills for salt has occurred to me, and I will mention it since I am on the subject:

"'Jimmy O'Kane, the Stillwater Hermit,' who lived years ago near the banks of the Beaver river, where Dunbar's Hotel is now, subsisted largely, when other game was difficult to get, on these birds. He would entice them under a large net by throwing salt there, and when they had gathered in sufficient numbers, he would spring it upon the unfortunate victims."

THE CANADA GROUSE, *Dendragapus* (Elliot) *canadensis*, (Linn). SOME REMARKS AS TO ITS SCARCITY, FEARLESSNESS, ITS HABITAT, AND ITS FEEDING ON THE TAMARACK, *Larix Americana*, Michx.

Read November 1, 1887.

By WM. HUBBELL FISHER.

The home of the Canada Grouse, familiarly known as the Spruce Partridge, is the forests and swamps of the northern portion of this Continent. The territory it inhabits includes the northern portions of the United States from the coast of Maine as far west as the Rocky Mountains—and in British America as far north as Alaska. In northern New York, one may travel many a long day without meeting with a single specimen. The universal verdict of all the guides and hunters whom I have met is to the effect that it is a very rare bird.

You will doubtless see a hundred specimens of the ruffed grouse before you will meet with a single Canada grouse. Baird states that it inhabits spruce forests and swamps. I was at Dunbar's Hotel, in the Adirondack region, on Stillwater, at the junction of Beaver River and Twitchell Creek, in Lewis County, New York, on the 31st of Aug., 1887. The day was declining when we heard several shots, which were supposed by Dunbar's folks to be a signal to send a boat over after a party coming out from Smith's Lake, or Muncie's. Not long after the party appeared, and among them was a Mr. C. N. Chapman, of Marathon, New York. He had shot a Canada grouse with his revolver. He stated that when first seen the bird was on a limb above him, that he shot and brought it to the ground. He did not tell me that he shot it after it fell to the ground, but from the bullet hole I found in the back of the bird, I am of the opinion that he gave it its death stroke after it had come to the earth. He stated that the bird did not appear to be wild or exhibit fear.

Before leaving Dunbar's, I took a boat and rowed over to where this partridge was shot. The overflow caused by the erection of the State dam on the Beaver River environed two sides of this tract. The locality was damp, gloomy, and wild; gnarled trunks and dead branches on the ground; bare dying trees, some deciduous hardwood trees in leaf, and some evergreens, made up

the foliage. The character of this spot verifies the statement of the guides that you will usually find this bird in the wildest places of the forests.

I had the good fortune to secure this bird, and at night while the hunters were gathered in the meeting room below, in the hotel, I went upstairs, skinned and dissected it. I found its stomach and crop full of leaves, which I showed to James Dunbar and another party, in the morning. They instantly recognized the leaves to be those of the tamarack tree, otherwise known as Hackmatack or Black Larch. (*Larix Americana*, Michx.) The tamarack leaves in the stomach were undergoing digestion.

The grouse was subsequently cooked and a more delicious bird I have never eaten. Mr. Scudder Todd, of Lyons Falls, and my son Schuyler and myself ate the bird, and all agreed that it was a delicious morsel. Sitting at the dining room table adjoining us was the Rev. Henry R. Lockwood, of Syracuse, with his family. He is a great sportsman, and has been for a number of years a summer occupant of one of Dunbar's cottages at Stillwater. I happened casually to mention to him that this grouse had been feeding on tamarack leaves. He immediately inquired whether the flesh was not bitter. I replied in the negative, and informed him that on the contrary, we found it very sweet, and savory and delicious. He expressed surprise and interest at the fact. He remarked that it had been supposed that toward the fall this grouse was compelled for lack of food to eat spruce leaves and the like, and that then its flesh became bitter and unpalatable and he was pleased to know to the contrary.

A HOME-STUDY IN NATURAL HISTORY.

"FREE TENANTS."

BY DR. FELIX L. OSWALD.

(Read November 1, 1887. See proceedings.)

The Spaniards have a proverb that "no gardener gardens for himself alone," and it is equally true that a considerable number of unbidden guests come in quest of lodging, as well as of board:

> **"Man ! all things love thee, near thee love to stay,**
> **To thee they hasten on their God-ward way,"**

rhymes old Tauler, who must have heard the ecstatic galloping of rats after the discovery of a Dutch cheese in a dry, snug pantry; and if God's vice-regent did not assert his supremacy by such belligerent methods his dwellings would often harbor as many free tenants as that Cingalese cave-temple where Sir Stanford Raffles found eight varieties of reptiles and six species of quadrupeds, besides birds and cats. No joiner's skill can wholly obviate such intruders. They enter through windows and cellar doors, through broken shingles and even through smoke flues, like the "chimney sweeper," as our Southern farmers call a variety of swift (*Cypselus pelagica*) that utilizes the crevices of rough-built stone chimneys, without being at all particular about a bit of smoke. In schoolhouses, used only in wintertime, swallows often build their nests on the inner walls, and, like the witches of mediæval folk-lore, use the chimney as a convenient thoroughfare, unless a broken window should afford collateral means of access.

Bats introduce themselves to still smaller crannies. About an hour after sunset my Texas landlord used to light a bonfire for the benefit of the Brazos river gnats, and in the glare of that con flagration I repeatedly watched a pair of spoon-ear bats that seemed to have their nest somewhere in the rafters of the loft. After a ten minutes' raid on the insect population of the night air they would alight on the upper edge of the weatherboards, close under the eaves of the roof, and squeeze themselves through a chink apparently just big enough for a cockroach. In the next minute the low, piping squeak of their youngsters would be heard from

somewhere in the rear of the loft, and then all was still. That same piping could sometimes be heard in the evening twilight, and at last enabled the landlord's boys to discover and demolish the nest, though only after a week's still hunt, for the tell-tale squeaks would cease at the least noise. But for those who come with less murderous intents the trouble of the search may repay itself by the sight of the strange, and really extravagantly uncouth little night-hags, that seem to represent all the monstrous types of the species in an exaggerated degree, as in certain kinds of birds, where the repulsive adult—the ugliest turkey-buzzard, for instance, is a paragon of beauty, compared with its pot-bellied and goggle-eyed youngsters.

The natural domicile of the insectivorous bat is in the recesses of large, hollow trees, but while forest destruction has sadly decimated the woodbirds of the eastern hemisphere, bats have survived the work of destruction by taking refuge in caves and ruins, thus helping nature, by stealth, as it were, to mitigate the worst results of the mischief,—the over-increase of noxious insects. In parts of Syria where birds are rarely seen outside of poultry yards, swarms of bats flutter at night, like guardian-spirits, about the scanty vestiges of arboreal vegetation, and disappear at sunrise in tombs and caves—in time to escape the malice of the superstitious natives. Various kinds of night-birds have been driven to similar shifts. In the agricultural regions of western Europe the *Strix flammea* has become a "barn-owl," sharing the daylight refuge of rats and mink, for the Germans have a *Haus marder*, or "house marten," a relative of the weasel, and equally fond of poultry, but withal apt to pay for its lodgings by its ceaseless warfare on mice and rats. A kindred night-prowler, the Missouri polecat, or "chicken mink," haunts the barns of our western grain states, and is still frequent enough in the far Northwest to furnish, under various synonyms, a considerable quota of American peltry.

In the South the word "polecat" is often applied to the common skunk, but the Missouri chicken-thief is neither a *mephitis*, nor a true mink, but a half-brother to the ermine and the English stote or "fitchet." There are two American varieties, the smaller one not much bigger than the Canada weasel, the larger a connecting link between the weasel and the mink proper. It passes the coldest winter days in a sort of dormouse sleep, and is so fond of a snug berth that nothing short of a conflagration or a first-class "vermin dog" will oust it from its dormitory in a weathertight barn, and on

many western farms a "*dachs-hund*" (badger-hunter), as the German call a bandy-legged variety of fox-terrier, is consequently in frequent request. American hunters might prefer to rely on gun powder arguments, and a combination method would perhaps be the best plan, unless it should lead to such unexpected results as in Reedsville, Wisconsin, where an old backwoodsman undertook to assist in the demolition of a "mink" that had been traced to the field-barn of a Scandinavian farmer. The proprietor's countrymen had turned out with orthodox clubs and pitchforks, and one of their youngsters undertook to test the prowess of the sharp-shooter, who had taken post outside the barn with his shotgun ready cocked. As soon as the *Dachs* gave tongue, Bjornson, Junior, clambered up to the top of the hay, and after peeping down through a nook of the caves, shook out his brown fur cap—just for a second; but the middle of that second was marked by the crack of a shotgun and a screech that made the size of that mink a subject of anxious conjectures. In the absence of chickens the rat-catching talents of the mink would make it worth while to protect his tenancy, as his slim shape gives him a decided advantage over all rivals, with the exception perhaps of the Turkish ferret that will follow its quarry into the highest penetralia of their burrows.

For similar reasons our next neighbors encourage the visits of a guest that would frighten a New England goodwife into convulsions. A rat-killing blacksnake, both bigger and glossier than its North-American cousin, and gifted with a knack of hunting in the dark, to judge from its exploits in the loft of a Mexican cabin. With its steelbright eyes that image of the tempter will glide along a rafter as noiseless as a shadow, and in pursuit of its prey often appears in the lower part of the house, darting to and fro like a hound on the track of a hare. Experience, though, has established the harmlessness of the *culebra* to the satisfaction of its patrons, who will insist that a good rat-snake is more efficient, as well as less expensive, and far cleanlier than the best cat. With a little coaxing and an occasional spoonful of milk those slippery pets will, indeed, become so tame that they can be handled like lap-dogs, especially by members of the family, whom they learn to approach without any symptoms of fear. If left to its own shifts, the rat-snake generally makes its headquarters in the dryest nook of the loft, but is apt to vanish for weeks together and then reappear so unexpectedly that the natives associate its comings and goings with all sorts of mystic fancies. "They won't stay in an unlucky house," an old Mestizo

assured me, "and they have a knowledge of things to come." "I saw one for the first time in the year after my mother died," he added in a whisper, and I sometimes think it must be her *criado*—her messenger; she wants to send me a warning. A less propitious familiar, a venomous species of spreading adder, occasionally enters the human habitations of the American tropics at the risk of its life, though the Mexicans sometimes tolerate it as a lesser evil, especially in such outhouses as a banana kiln, where rats have to be kept down by foul or fair means.

Even the *Mephistis chinga*, or common sknuk, is apt to share the roof of God's viceregent by burrowing under the floor of a convenient country house, without ever molesting his landlord or even crossing the path of the prowling watch-dog. In case of an accidental encounter he will try to save himself by any expedient before resorting to his decisive weapon, evidently disliking to risk sensational results of that *ultima ratio.* That disposition to spare the neighborhood of their headquarters seems, indeed, an almost universal instinct, even of the lower animals.

My Georgia country-house having stood vacant for two years, a swarm of hornets had established themselves under the roof of a rear porch, and seemed at first to resent my intrusion, but in the course of a week apparently concluded to waive their pre-emption claims, and ever after kept the peace in spite of manifold persecutions On rainy days one of my pet monkeys makes a rafter of that porch a favorite roost, and had never got any reason to repent his confidence in the pacific disposition of the winged community in the immediate proximity of his perch, though his neighbors belonged to that especially aggressive steel-blue variety, which out in the woods are apt to flaunt their battle-flag on very slight provocation. One day a mischievous youngster tried to precipitate a conflict by flinging a stone against the board directly under the nest. A formidable posse at once sallied with a buzz that made the monkey retreat to the further corner of his perch, but after booming about for a couple of minutes in a sort of puzzled and reproachful way, the skirmishers returned to report for further instructions, and soon after resumed their day's work as if nothing had happened.

The beef-packers of Northern Mexico are haunted by dogs of such vile breeds that they frequently associate with the more than half-wild *perros pelones*, or prairie curs, that visit the scrap-piles in cold winters. But neither dogs nor curs ever trouble the poultry-

yard of the proprietor, nor the drying-yard where jerked beef hangs about by the thousand pounds in tempting slices. Nay, dogs and perros promptly combine to defend such property against the raids of the predatory coyotes, and at first sight of those intruders enact a steeple chase too fierce and persistent to be a mere piece of eye-serving bravado. Business rivalry would partly explain their zeal, but old Tauler is not altogether wrong. The neighborhood of man for his own sake seems to exert an attractive influence on some species of animals, as in Burmah, where the woods abound with wild fruit, and troops of monkeys nevertheless insist on congregating about the huts of the natives. Religious prejudices oblige the peasants to spare such visitors; and, like country-cousins, the four-handers decline to leave on any but the strongest hints. They do not sow, neither do they spin, but they obtain a share in all sorts of farm produce; they filthy the roof, they appropriate kerchiefs and ribbons; but withal take a sort of family interest in the welfare of their landlord, for at the approach of a stranger or a strange dog they break forth in excited grunts, or even leap from the roof and strut about the door, bristling with suspicion and pugnacity. Fruit is a drug in the Burmah market, but where the finer varieties are raised for export, the effrontery of those long-tailed tenants becomes a fearful nuisance. They will snatch all they can eat, and at the slightest symptom of protest fly into a paroxysm of virtuous indignation, like the Franciscan beggar monks of Spain, who were so used to the free lunches of country taverns that they attempted to raid the restaurant of a North Spanish railway junction, till the French proprietor bethought himself of moderating their appetite by a judicious admixture of calomel.

The traveler, Burton, tells a good story of a Fanti warrior, who had been watching a number of imported coolies chopping cordwood for a British trading-post on the coast of Zanzibar.

"What a waste of trouble!" muttered the chieftain; "why, with half as many hard licks they could have knocked h— out of the biggest nigger settlement in the land and helped themselves to all they need."

With a similar surprise our carnivorous redskins would probably witness the toil of a starving Hindoo who fails to avail himself of an ample meat-supply in the next neighborhood of his cottage. The established prejudice against an attempt on the life of any of man's fellow-creatures is so strong that an orthodox follower of

Brahma will not even kill vermin; but besides, various members of the animal creation are venerated as half-divine, and unfortunately the list of those hereditary saints includes some of the most mischievous brutes of the wilderness. At least three species of monkeys are sacred to the degree of being absolutely inviolate: the Rhesus, the Bhunder-baboon, and Hanuman (*Semnopithecus entellus*). The last named species of demigods are as long-legged as our Brazilian spider-monkeys, and with a single leap can clear a thorn hedge of twelve feet, and climb masonry with the facility of a wall spider.

Whole regiments of these lank marauders will quarter themselves on a single farm, and appropriate the lion's share of the produce, unless the farmer should forestall their modesty by gathering his fruits before their season and let them ripen in a closed drying bin. More violent methods of self-defense would draw down the implacable vengeance of Brahma, who has taken the Hanuman under his special protection.

The hunchbacked bull decimates the pastures, and is too holy to be kicked even if he should invade a truck farm, or leave his trade-mark on the sidewalk of a decent town. "Oh, my son, oppress not the poor," Van Orlich heard a Hindoo farmer adjure a voracious bull. "Come, my child, I will feed thee with honey if thou wilt follow me." The bull continued to help himself. "Provoke not the weak," resumed the Hindoo; "Brahma is just; come, repent in time." The bull never budged, and the farmer at last summoned two companions. "Oh, my son," they began again, but at the same time two of them seized the bull's horns left and right, and thus trotted him, chanting a passage from the Upanishads, while their assistant enforced the quotation by hammering a board with a sort of mallet.

A Brahma bull has been known to enter the very house of a green-truck vender and devour a basketful of turnips while the children hid the yam-roots in a rear room. A tiger might have followed his victims even to that last sanctuary, for, unfortunately, he too is *madeo saccat*, "Great God protected," and must under no circumstances be discouraged by bodily violence. Crocodiles are so holy that several sects of orthodox Brahmins throw corpses into the Ganges for the sake of the blest sepulture in the bowels of the sacred saurians. Swarms of pigeons haunt the rice fields, and are likewise too holy for direct opposition, and the planter himself seems to be satisfied with a modest percentage of his harvest; for

the natives have a proverb that "monkey will take what the pigeon spares,"—the stout Rhesus baboon being apt to anticipate the charity of the public by breaking into a store-room during the momentary absence of the proprietor.

"Patience is proved by trials," quote the pious natives, and that reflection might console the settlers of the Southern Alleghanies where flying squirrels begin to share the tenure of a woodland farm. Ordinary precautions are unavailing against the talents of a marauder that can dig, gnaw and climb, as well as run and fly, and whose appetite is almost as versatile as his manner of locomotion. The *Pteromys volucella* is, indeed, as much of a rat as of a squirrel, and I have caught one in the act of gnawing the wing-bones of a stuffed bird. They will gnaw oiled leather, pilfer corn, peanuts, dried apples, raisins, beans, cheese, bacon and bread. Like their larger relatives they make storage nests as well as nurseries, often in the very bedroom of their landlord, but their restless raids make it rather difficult to discover their hiding places; one may watch them for half an hour and see them enter half a thousand different crannies, as well that concealing their young. Rats have established runs, and can be trapped, but their acrobatic cousins are nowhere and everywhere, and would be a more unexpungable pest than red ants if it were not for their indiscriminate appetite, while arsenic (arsenious acid) can now be had at fifteen cents a pound, and half an ounce is enough to clean out a bushel bag full of the little lunch fiends. The best admixture is cornmeal stirred with a bit of pot-grease. A California squirrel catcher recommends *nut oil* (walnut oil) as an infallible bait, but for domestic purposes I have found a crushed hickory kernel about equally effective. Mix the pounded contents of three or four hickory nuts with a pint of cornmeal, a few drops of dishwater and a pinch of arsenic; then distribute in teaspoon doses in places beyond the reach of domestic animals, and await results. Where flying squirrels abound they will soon cease to fly, and abound chiefly in the ash barrel. The first night may be remarkable for their more than usually obstreperous activity, but the next morning their ex-animate forms will be found about the floor in strangely life-like attitudes—petrified, as it were, in the act of racing for the door, and still bearing an expression of considerable surprise. Strychnine is more expensive, besides being less available on account of its intensely bitter taste.

FELIX L. OSWALD.

ZOOLOGICAL MISCELLANY.

CONDYLURA *cristata* (Linn.) Desmarest. Star-nosed Mole·

According to Dr. Brayton's list, Vol. IV., [Zoology and Botany] of the Geological Survey of Ohio, two specimens of this species have been recorded for Ohio, and I do not know that others have been noted since the date of that publication. So far as I can learn no one has published the occurrence of this species within Indiana. Late in October last I recieved a letter from Mr. J. C. Cunningham, of Denver, Ind., saying he had a specimen of the Star-nosed Mole from that vicinity. Upon further inquiry he kindly sent me the specimen for examination together with the circumstances of its capture which are in brief, as follows. "I found the mole dead in front of my house where I suppose it had been dropped by a cat. The date was July 5, 1887. Place one mile north of Denver. The specimen is now in the collection of the State Normal School, Terre Haute, Ind. AMOS W. BUTLER.

BROOKVILLE, IND., *January* 3. 1888.

NOTES CONCERNING ALBINISM AMONG BIRDS.

The recent extensive contribution to our knowledge of this subject by my friend, Mr. Geo. L. Toppan, in Bulletin No. 2, of the Ridgway Orinthological Club, of Chicago, apparently leaves little to be said. As I have had the opportunity of examining an example of at least one species having albinistic tendency, not given by him, I thought a few notes upon some species which more commonly show this peculiarity might be acceptable.

Merula migratoria (Linn.) AMERICAN ROBIN.

A specimen in my collection, No. 1453, is of unusual beauty. The lower parts, tail and back are of nearly normal color. A few white spots on the breast alone relieve the reddish. About half the primaries, most of the secondaries and some of the feathers of the wing coverts are white. The neck is almost encircled by a ring which is white on the back and drab sprinkled with whitish on the sides. The crown and sides of the head have perhaps one third of the feathers white. The specimen as it lies in the cabinet gives but a poor idea of the beauty of this bird as it appeared among a flock of perhaps fifty of its species.

Parus bicolor (Linn.) Tufted Tidmouse.

In the collection of A. W. Brayton, M. D., Indianapolis, Ind., is a Tufted Titmouse which is all white excepting the two middle tail feathers, the primaries and two or three feathers in the crest.

Sitta carolinensis (Lath.) White-breasted Nuthatch.

In March last I had sent to me by Mr. E. L. Guthrie, Adams, Ind., a specimen of this bird of the pallescent form of albinism. It was very pale drab, in some parts almost white. The specimen is now in the collection of Mr. Forrest West, Greensburg, Ind.

Regulus satrapa (Licht.) Golden-crowned Kinglet.

So far as I am aware no albinos have been reported from the birds of this genus. A specimen in my collection, No. 3106, from Raleigh, N. C., has the head, wings and lower parts of the regulation colors, but the remaining feathers are yellowish-white and ashy white excepting the tail, the outer vanes of which are broadly marked with the former color, the remaining parts being of normal coloration.

Ampelis cedrorum (Vieill.) Cedar Waxwing.

No. 2154 of my collection is almost pure white. One secondary in each wing, one feather in the greater coverts of the left wing, a few spots on the sides of the neck show traces of the usual color. The belly and tip of the tail shows the usual yellow tint. The waxen tips of the wing feathers are present. The bill and feet are very pale.

Passer domestica (Linn.) House Sparrow.

Birds of this species with albinistic tendencies are quite common. Generally they have part of the plumage decidedly paler than the usual colors, but occasionally one is found of a creamy tint over most of the body. As the number of sparrows increases, so do the pale colored individuals, and sometimes two or three noticable birds appear in a single flock.

Quiscalus quiscala æneus (Ridgw.) Bronzed Grackle.

For several years a Bronzed Grackle having one of the primaries of its left wing white, appeared in a certain locality near Brookville. Its conspicuous mark made it the target for many a gun and doubtless some unlucky hunter caused its death.

Melanerpes erythrocephalus (Linn.) Red-headed Woodpecker.

Two or three years ago, near Laurel, Ind., a pair of these birds reared a brood of five, three of which appeared to be pure white. On two or three occasions I passed close to their home and was unable to distinguish any of the bright colors of their species. Amos W. Butler.

Brookville, Ind., *January* 4, 1888.

Albinos in Cuvier Club Collection.

(No. 215.)
Red Tailed Hawk.
Buteo borealis, (Gmel.)

A fine male from Clinton Co., Ohio, plumage pure clear white all over. Iris dark-brown.

(No. 838.)
Crow.
Corvus americanus, (Aud.)

Young, male, pure white. Iris pink. Greene Co., Ohio.

(No. 839.)
Crow.
Corvus americanus, (Aud.)

Adult, female, white slightly tinged with buff. Iris dark-brown. Ky.

(No. 393.)
Wilson's Snipe.
Gallinago delicata, (Ord.)

Buff white. Hamilton Co., Ohio.

(No. 1215.)
Bronzed Grakle.
Quiscalus quiscala æneus, (Ridgw.)

A partial albino of great beauty. Adult. The entire crown, nape, tail and part of wings pure white, under parts normal color except that belly feathers are slightly lunulated with silvery white. Indian Hill, Ohio.

(No. 771.)
Tree Sparrow.
Spizella monticola, (Gmel,)

Partial Albino. White with brown patches. Hamilton Co., Ohio.

(Nos. 754, 755, 756.)

"BOB WHITE."

Colinus virginianus, (Linn.)

Three partial Albinos. One from Columbus, Ohio, pale buff with the darker markings of the species sharply impressed.

Two from Indiana. Male and female. Nearly white with all markings very faintly exhibited.

(No. 564.)

ROBIN.

Merula migratoria, (Linn.)

Adult, male. Entire upper parts buff white, breast normally colored. Indiana.

CHAS. DURY.

CINCINNATI, January, 1888.

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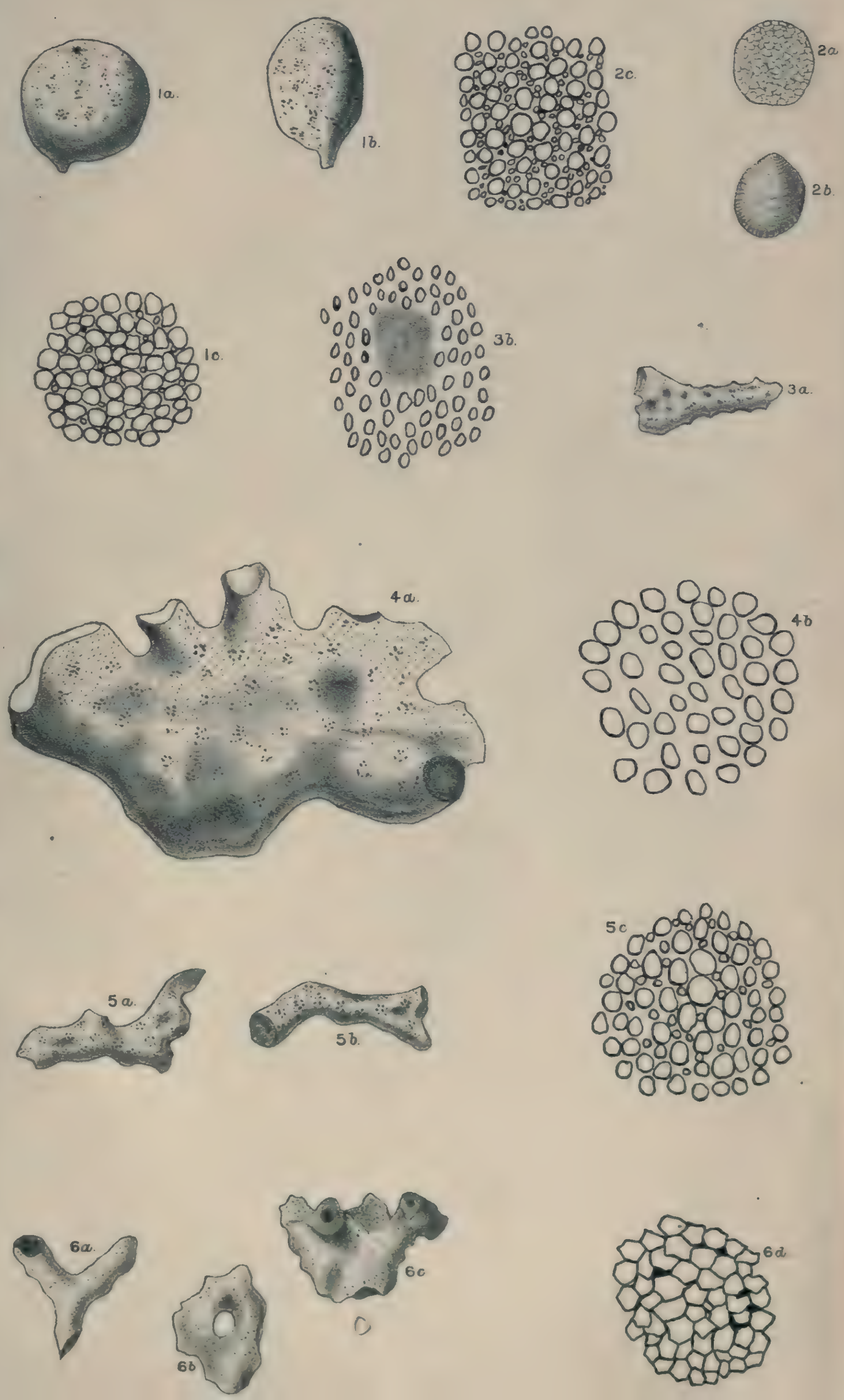
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